

N-Channel Power MOSFET

60V, 28A, 28mΩ

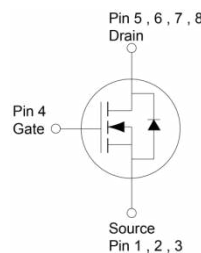
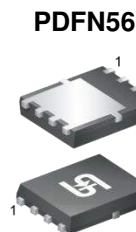
FEATURES

- Low $R_{DS(on)}$ to minimize conductive losses
- Logic level
- Low gate charge for fast power switching
- 100% UIS and R_g tested.
- 175°C Operating Junction Temperature
- Compliant to RoHS directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

APPLICATIONS

- BLDC Motor Control
- Battery Power Management
- DC-DC converter
- Secondary Synchronous Rectification

| KEY PERFORMANCE PARAMETERS | | |
|----------------------------|-----------------|------|
| PARAMETER | VALUE | UNIT |
| V_{DS} | 60 | V |
| $R_{DS(on)}$ (max) | $V_{GS} = 10V$ | 28 |
| | $V_{GS} = 4.5V$ | 39 |
| Q_g | 9 | nC |



Note: MSL 1 (Moisture Sensitivity Level) per J-STD-020

| ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted) | | | |
|---|----------------|---------------------------|------------------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | V_{DS} | 60 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Continuous Drain Current ^(Note 1) | I_D | $T_C = 25^\circ\text{C}$ | 28 |
| | | $T_A = 25^\circ\text{C}$ | 7 |
| Pulsed Drain Current | I_{DM} | 112 | A |
| Single Pulse Avalanche Current ^(Note 2) | I_{AS} | 12 | A |
| Single Pulse Avalanche Energy ^(Note 2) | E_{AS} | 22 | mJ |
| Total Power Dissipation | P_D | $T_C = 25^\circ\text{C}$ | 56 |
| | | $T_C = 125^\circ\text{C}$ | 19 |
| Total Power Dissipation | P_D | $T_A = 25^\circ\text{C}$ | 3.1 |
| | | $T_A = 125^\circ\text{C}$ | 1 |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | - 55 to +175 | $^\circ\text{C}$ |

| THERMAL PERFORMANCE | | | |
|--|-----------------|-------|---------------------------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Junction to Case Thermal Resistance | $R_{\theta JC}$ | 2.7 | $^\circ\text{C}/\text{W}$ |
| Junction to Ambient Thermal Resistance | $R_{\theta JA}$ | 48 | $^\circ\text{C}/\text{W}$ |

Thermal Performance Note: $R_{\theta JA}$ 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. The $R_{\theta JA}$ limit presented here is based on mounting on a 1 in² pad of 2 oz copper.

| ELECTRICAL SPECIFICATIONS ($T_A = 25^\circ\text{C}$ unless otherwise noted) | | | | | | |
|---|---|--------------|-----|-----|-----------|---------------|
| PARAMETER | CONDITIONS | SYMBOL | MIN | TYP | MAX | UNIT |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$ | BV_{DSS} | 60 | -- | -- | V |
| Gate Threshold Voltage | $V_{GS} = V_{DS}, I_D = 250\mu\text{A}$ | $V_{GS(TH)}$ | 1 | 2 | 2.5 | V |
| Gate-Source Leakage Current | $V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$ | I_{GSS} | -- | -- | ± 100 | nA |
| Drain-Source Leakage Current | $V_{GS} = 0\text{V}, V_{DS} = 60\text{V}$ | I_{DSS} | -- | -- | 1 | μA |
| | $V_{GS} = 0\text{V}, V_{DS} = 60\text{V}$ $T_J = 125^\circ\text{C}$ | | -- | -- | 100 | |
| Drain-Source On-State Resistance (Note 3) | $V_{GS} = 10\text{V}, I_D = 7\text{A}$ | $R_{DS(on)}$ | -- | 24 | 28 | m Ω |
| | $V_{GS} = 4.5\text{V}, I_D = 6\text{A}$ | | -- | 32 | 39 | |
| Forward Transconductance (Note 3) | $V_{DS} = 10\text{V}, I_D = 7\text{A}$ | g_{fs} | -- | 31 | -- | S |
| Dynamic (Note 4) | | | | | | |
| Total Gate Charge | $V_{GS} = 10\text{V}, V_{DS} = 30\text{V},$ $I_D = 7\text{A}$ | Q_g | -- | 18 | -- | nC |
| Total Gate Charge | $V_{GS} = 4.5\text{V}, V_{DS} = 30\text{V},$ $I_D = 6\text{A}$ | Q_g | -- | 9 | -- | |
| Gate-Source Charge | | Q_{gs} | -- | 3 | -- | |
| Gate-Drain Charge | | Q_{gd} | -- | 4 | -- | |
| Input Capacitance | $V_{GS} = 0\text{V}, V_{DS} = 30\text{V}$ $f = 1.0\text{MHz}$ | C_{iss} | -- | 969 | -- | pF |
| Output Capacitance | | C_{oss} | -- | 71 | -- | |
| Reverse Transfer Capacitance | | C_{rss} | -- | 24 | -- | |
| Gate Resistance | $f = 1.0\text{MHz}$ | R_g | 0.7 | 2.4 | 4.8 | Ω |
| Switching (Note 4) | | | | | | |
| Turn-On Delay Time | $V_{GS} = 10\text{V}, V_{DS} = 30\text{V},$ $I_D = 7\text{A}, R_G = 2\Omega$ | $t_{d(on)}$ | -- | 1 | -- | ns |
| Turn-On Rise Time | | t_r | -- | 19 | -- | |
| Turn-Off Delay Time | | $t_{d(off)}$ | -- | 10 | -- | |
| Turn-Off Fall Time | | t_f | -- | 18 | -- | |
| Source-Drain Diode | | | | | | |
| Forward Voltage (Note 3) | $V_{GS} = 0\text{V}, I_S = 7\text{A}$ | V_{SD} | -- | -- | 1.2 | V |
| Reverse Recovery Time | $I_S = 7\text{A},$ | t_{rr} | -- | 11 | -- | ns |
| Reverse Recovery Charge | $di/dt = 100\text{A}/\mu\text{s}$ | Q_{rr} | -- | 5 | -- | nC |

Notes:

- Silicon limited current only.
- $L = 0.3\text{mH}, V_{GS} = 10\text{V}, V_{DD} = 30\text{V}, R_G = 25\Omega, I_{AS} = 12\text{A}$, Starting $T_J = 25^\circ\text{C}$
- Pulse test: Pulse Width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
- Switching time is essentially independent of operating temperature.

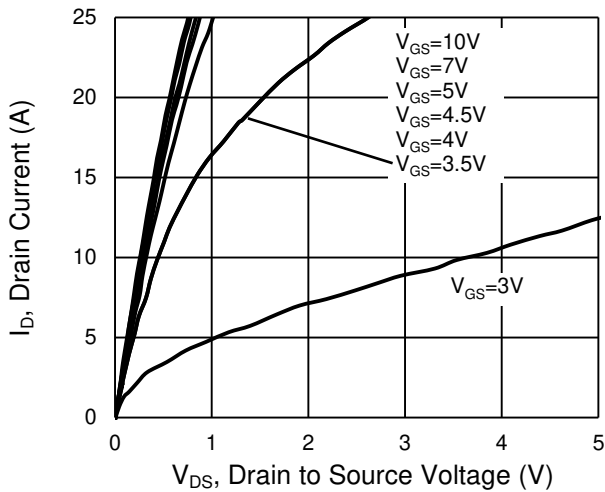
ORDERING INFORMATION

| PART NO. | PACKAGE | PACKING |
|-------------------|---------|---------------------|
| TSM280NB06LCR RLG | PDFN56 | 2,500pcs / 13" Reel |

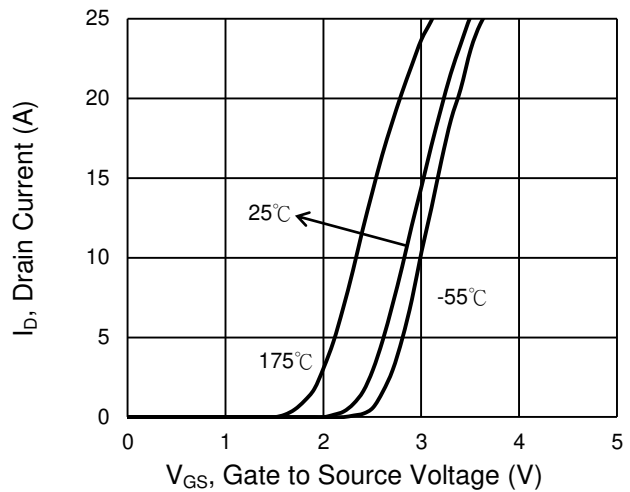
CHARACTERISTICS CURVES

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

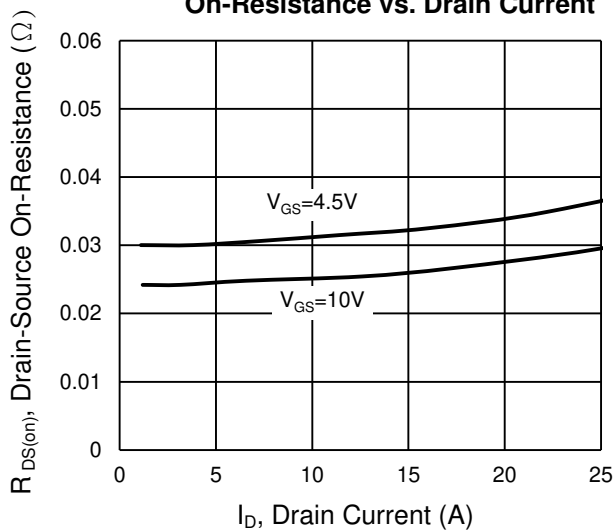
Output Characteristics



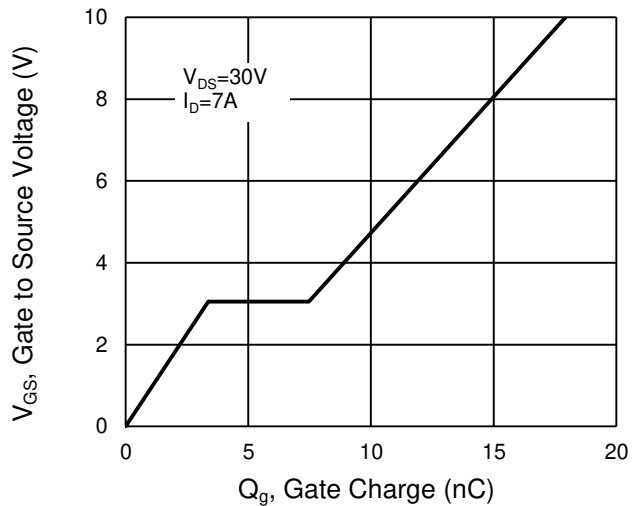
Transfer Characteristics



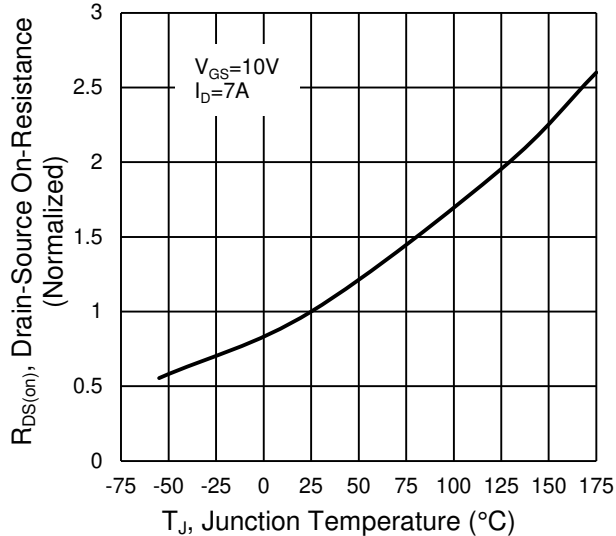
On-Resistance vs. Drain Current



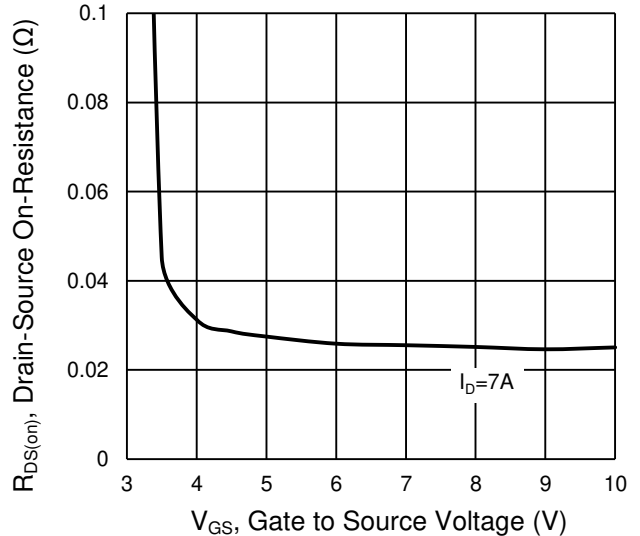
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



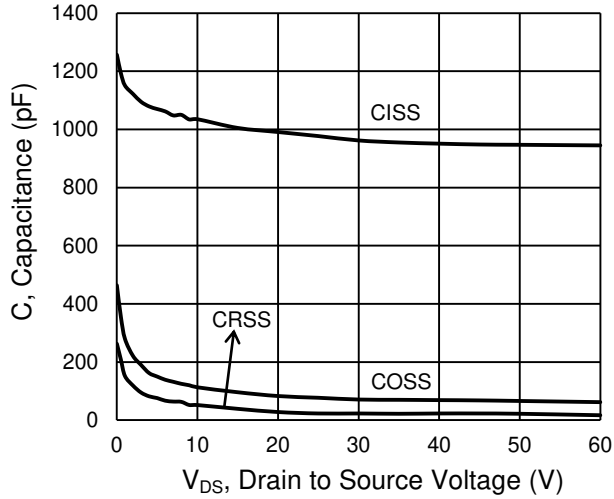
On-Resistance vs. Gate-Source Voltage



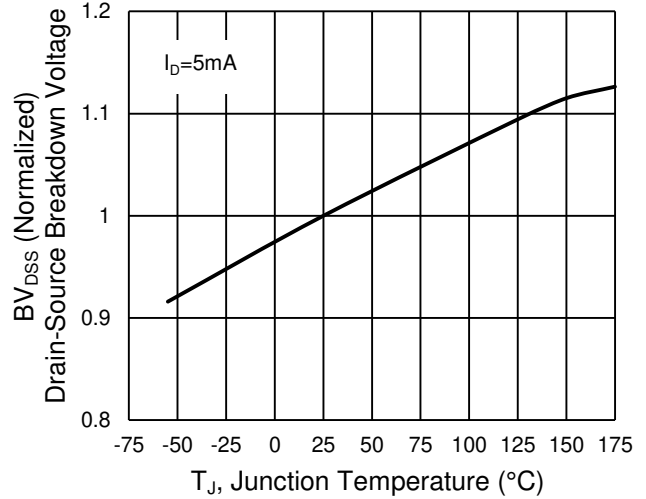
CHARACTERISTICS CURVES

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

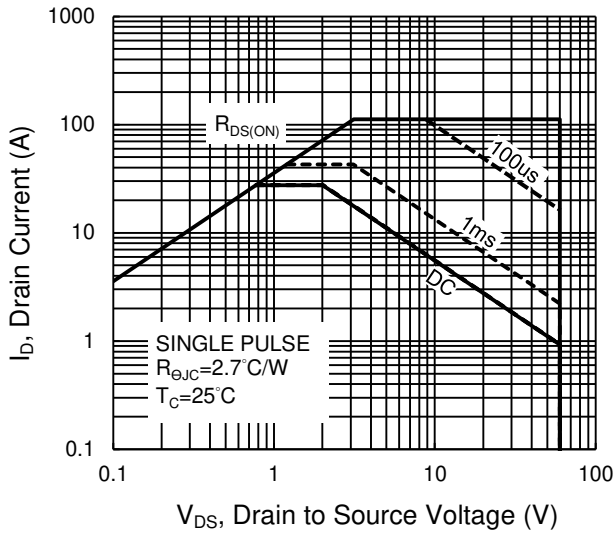
Capacitance vs. Drain-Source Voltage



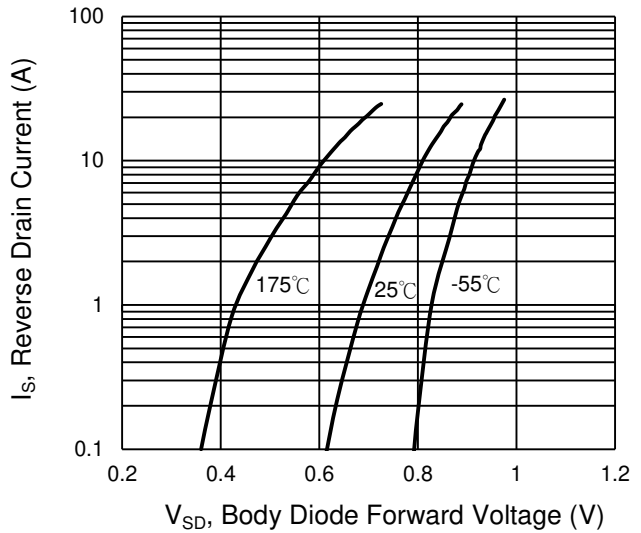
BV_{DSS} vs. Junction Temperature



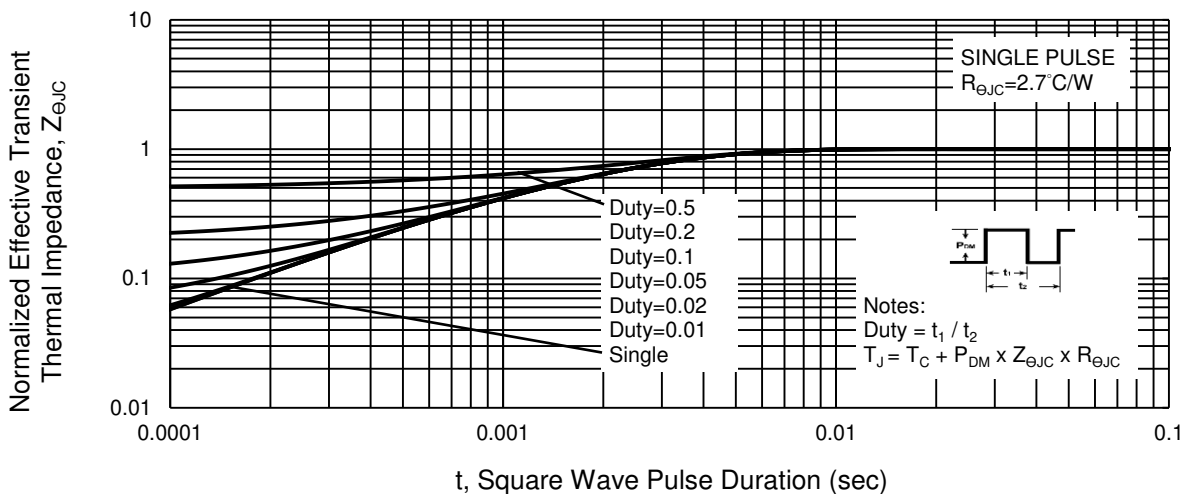
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage

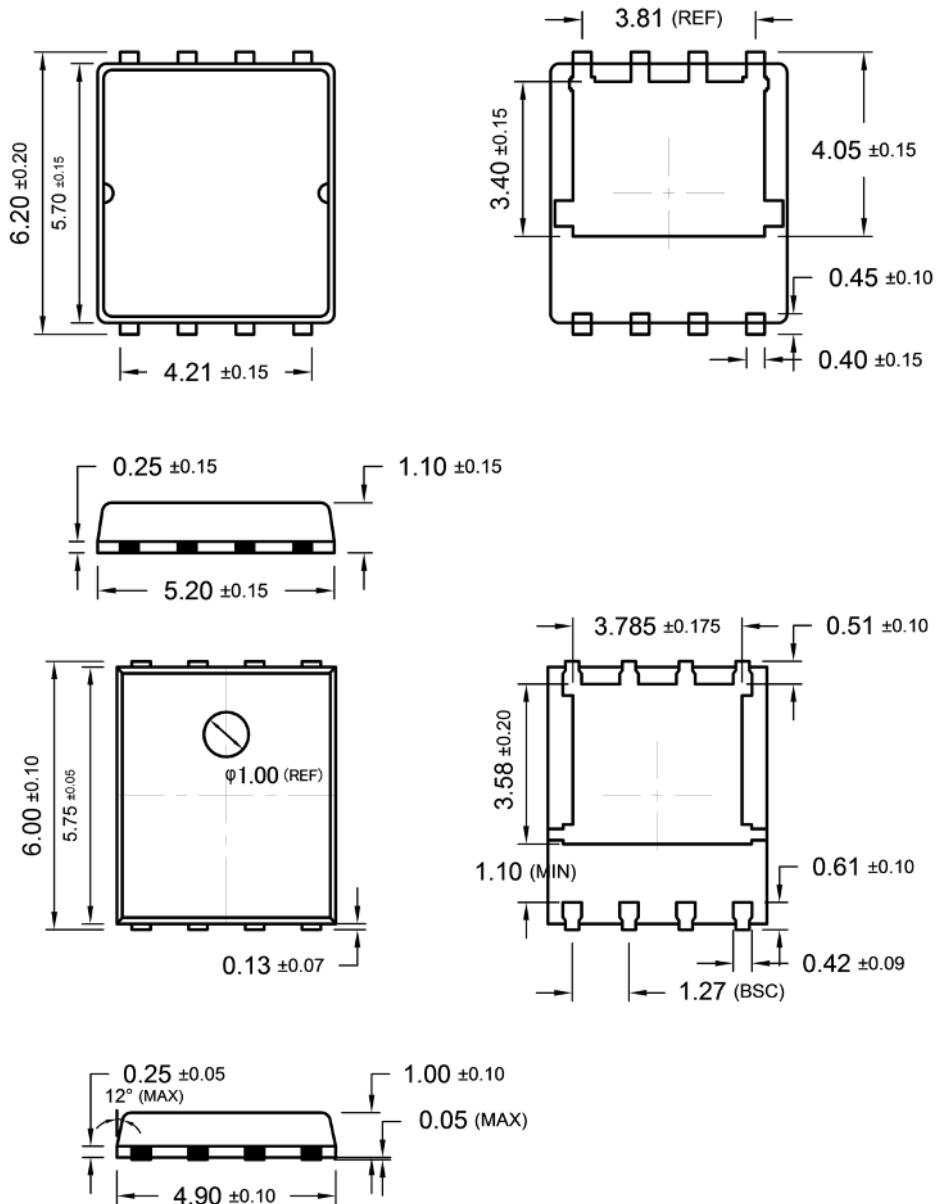


Normalized Thermal Transient Impedance, Junction-to-Case

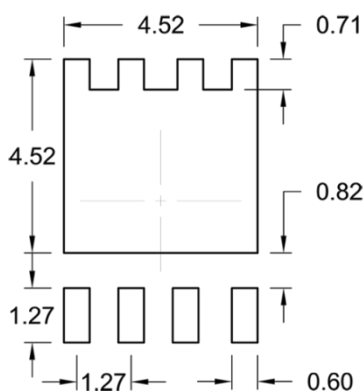


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

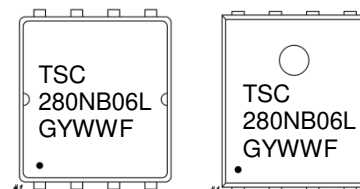
PDFN56



SUGGESTED PAD LAYOUT (Unit: Millimeters)



MARKING DIAGRAM



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

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