

IV1Q12050T4 – 1200V 50mΩ SiC MOSFET

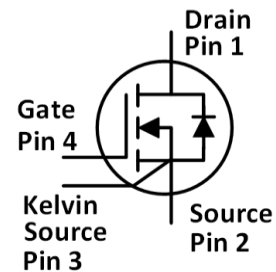
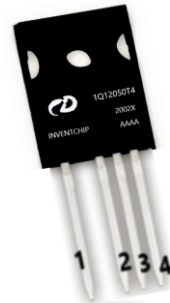
Features:

- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- High operating junction temperature capability
- Very fast and robust intrinsic body diode
- Kelvin gate input easing driver circuit design

Applications:

- Solar inverters
- UPS
- Motor drivers
- High voltage DC/DC converters
- Switch mode power supplies

Package:



| Part Number | Package |
|-------------|---------|
| IV1Q12050T4 | TO247-4 |

Absolute Maximum Ratings (T_c=25°C unless otherwise specified)

| Symbol | Parameter | Value | Unit | Test Conditions | Note |
|------------------|--------------------------------|------------|------|----------------------------------------------------------------|---------|
| V _{DS} | Drain-Source voltage | 1200 | V | V _{GS} =0V, I _D =100μA | |
| V _{GS} | Gate-Source voltage | -5 to 20 | V | Recommended maximum | |
| I _D | Drain current (continuous) | 58 | A | V _{GS} =20V, T _C =25°C | Fig. 21 |
| | | 43 | A | V _{GS} =20V, T _C =100°C | |
| I _{DM} | Drain current (pulsed) | 145 | A | Pulse width limited by SOA | Fig. 24 |
| P _{TOT} | Total power dissipation | 344 | W | T _C =25°C | Fig. 22 |
| T _{stg} | Storage temperature range | -55 to 175 | °C | | |
| T _J | Operating junction temperature | -55 to 175 | °C | | |
| T _L | Solder Temperature | 260 | °C | Wave soldering only allowed at leads, 1.6mm from case for 10 s | |

Thermal Data

| Symbol | Parameter | Value | Unit | Note |
|---------------------|------------------------------------------|-------|------|---------|
| R _{θ(j-c)} | Thermal Resistance from Junction to Case | 0.436 | °C/W | Fig. 23 |

Electrical Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Value | | | Unit | Test Conditions | Note |
|---------------------|-----------------------------------|-------|-------|-----------|------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| | | Min. | Typ. | Max. | | | |
| I_{DSS} | Zero gate voltage drain current | | 5 | 100 | μA | $V_{DS}=1200\text{V}, V_{GS}=0\text{V}$ | |
| I_{GSS} | Gate leakage current | | 1 | ± 100 | nA | $V_{DS}=0\text{V}, V_{GS}=-5\sim 20\text{V}$ | |
| V_{TH} | Gate threshold voltage | | 3.2 | | V | $V_{GS}=V_{DS}, I_D=6\text{mA}$ | Fig. 8, 9 |
| | | | 2.2 | | | $V_{GS}=V_{DS}, I_D=6\text{mA}$ @ $T_c=175^\circ\text{C}$ | |
| R_{ON} | Static drain-source on-resistance | | 50 | 65 | $\text{m}\Omega$ | $V_{GS}=20\text{V}, I_D=20\text{A}$ @ $T_j=25^\circ\text{C}$ | Fig. 4, 5, 6, 7 |
| | | | 80 | | $\text{m}\Omega$ | $V_{GS}=20\text{V}, I_D=20\text{A}$ @ $T_j=175^\circ\text{C}$ | |
| C_{iss} | Input capacitance | | 2750 | | pF | $V_{DS}=800\text{V}, V_{GS}=0\text{V},$ $f=1\text{MHz}, V_{AC}=25\text{mV}$ | Fig. 16 |
| C_{oss} | Output capacitance | | 106 | | pF | | |
| C_{rss} | Reverse transfer capacitance | | 5.2 | | pF | | |
| E_{oss} | C_{oss} stored energy | | 43 | | μJ | | Fig. 17 |
| Q_g | Total gate charge | | 120 | | nC | $V_{DS}=800\text{V}, I_D=20\text{A},$ $V_{GS}=-5\text{ to }20\text{V}$ | Fig. 18 |
| Q_{gs} | Gate-source charge | | 25 | | nC | | |
| Q_{gd} | Gate-drain charge | | 48 | | nC | | |
| R_g | Gate input resistance | | 2.8 | | Ω | $f=1\text{MHz}$ | |
| E_{ON} | Turn-on switching energy | | 455.4 | | μJ | $V_{DS}=800\text{V}, I_D=30\text{A},$ $V_{GS}=-2\text{ to }20\text{V},$ $R_{G(\text{ext})}=3.3\Omega,$ $L=450\mu\text{H}$ | Fig. 19, 20 |
| E_{OFF} | Turn-off switching energy | | 213.6 | | μJ | | |
| $t_{d(\text{on})}$ | Turn-on delay time | | 8.9 | | ns | | |
| t_r | Rise time | | 28.9 | | | | |
| $t_{d(\text{off})}$ | Turn-off delay time | | 25.6 | | | | |
| t_f | Fall time | | 17.2 | | | | |

Reverse Diode Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Value | | | Unit | Test Conditions | Note |
|-----------|-------------------------------|-------|-------|------|------|----------------------------------------------------------------------------------------------------------------|--------------------|
| | | Min. | Typ. | Max. | | | |
| V_{SD} | Diode forward voltage | | 4.9 | | V | $I_{SD}=20\text{A}, V_{GS}=0\text{V}$ | Fig. 10, 11, 12 |
| | | | 4.4 | | V | $I_{SD}=20\text{A}, V_{GS}=0\text{V},$ $T_J=175^\circ\text{C}$ | |
| t_{rr} | Reverse recovery time | | 44.4 | | ns | $V_{GS}=-2\text{V}/+20\text{V},$ $I_{SD}=30\text{A}, V_R=800\text{V},$ $di/dt=1000\text{A}/\mu\text{s},$ | |
| Q_{rr} | Reverse recovery charge | | 212.6 | | nC | $R_{G(\text{ext})}=10\Omega$ | |
| I_{RRM} | Peak reverse recovery current | | 10.8 | | A | $L=450\mu\text{H}$ | |

Typical Performance (curves)

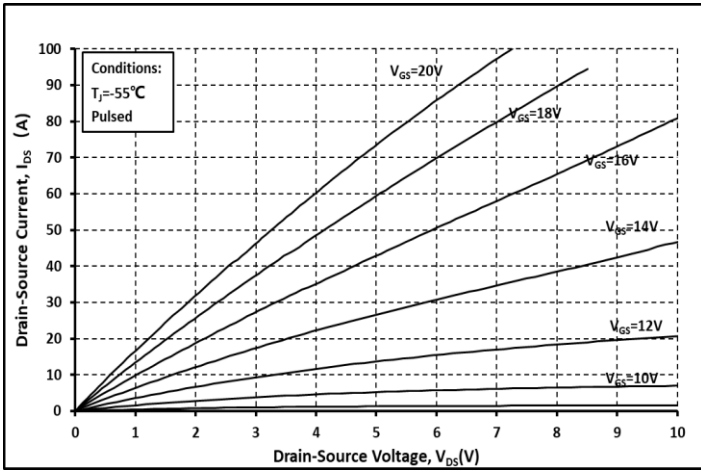


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

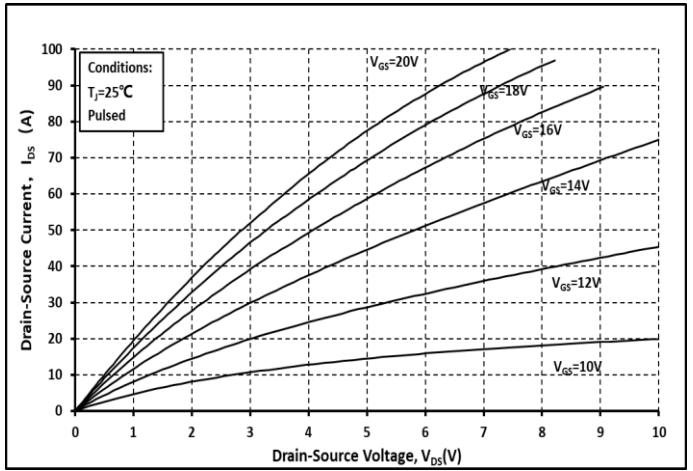


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

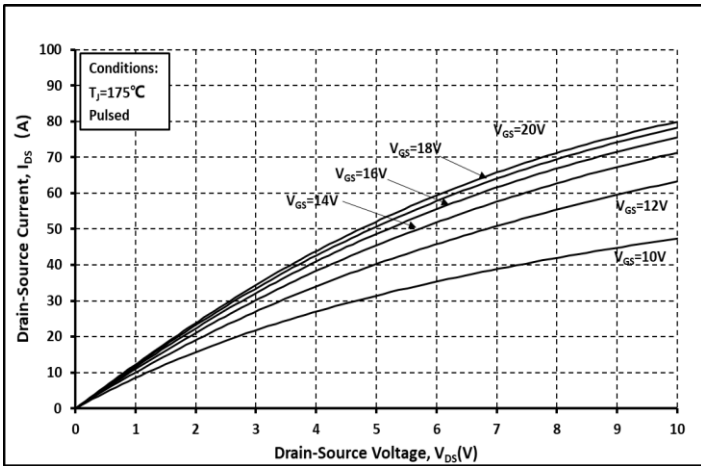


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

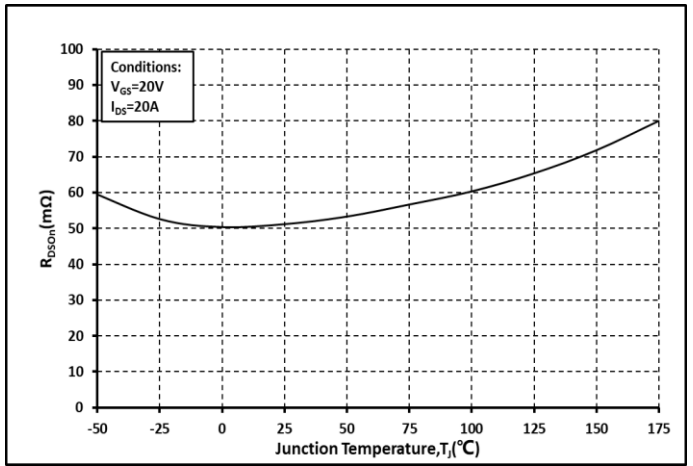


Fig. 4 R_{on} vs. Temperature

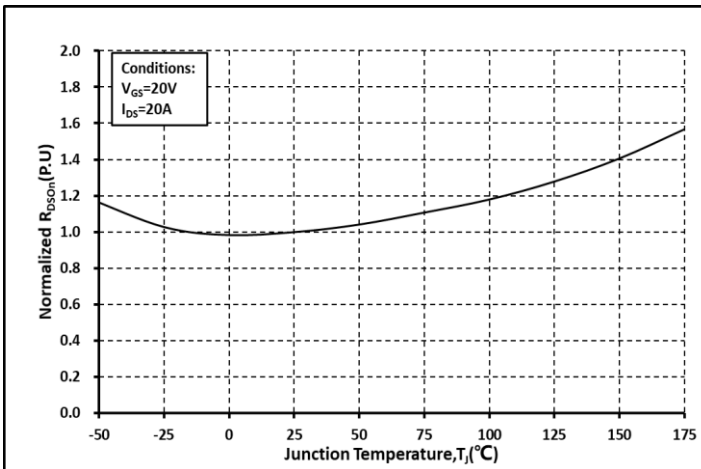


Fig. 5 Normalized R_{on} vs. Temperature

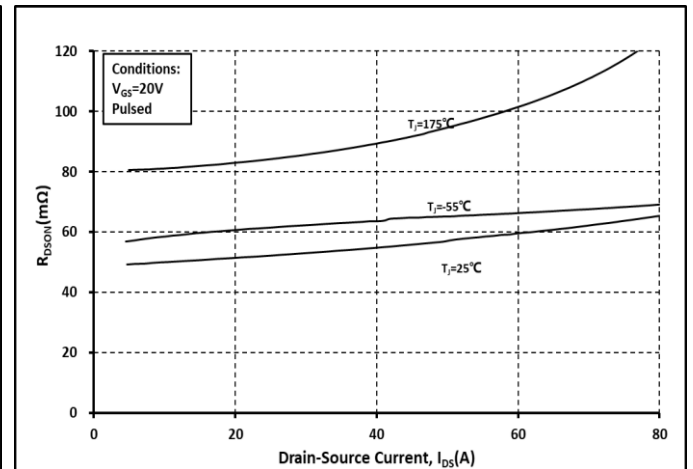


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

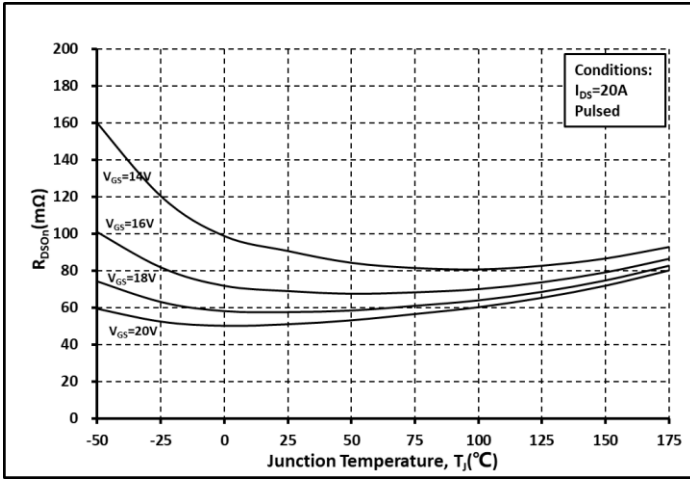


Fig. 7 Ron vs. Temperature @ Various V_{GS}

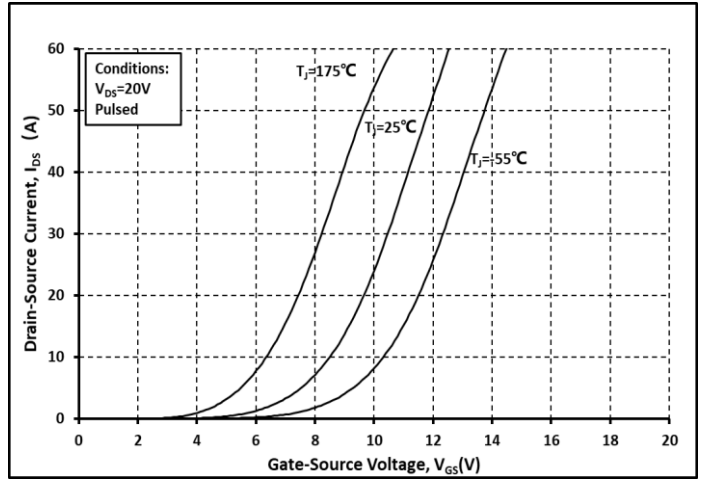


Fig. 8 Transfer Curves @ Various Temperature

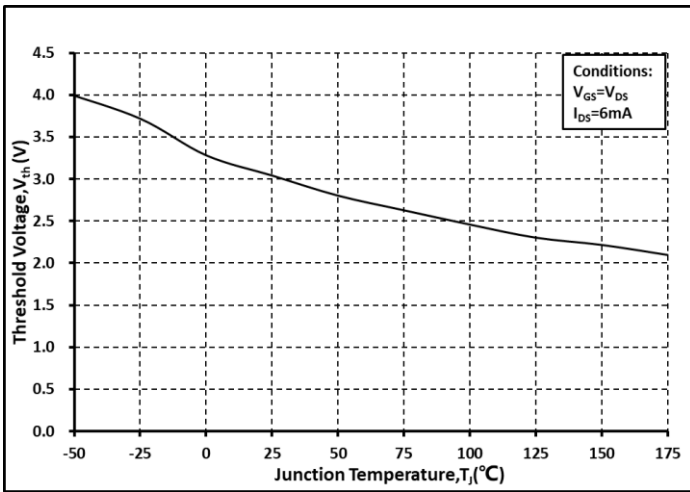


Fig. 9 Threshold Voltage vs. Temperature

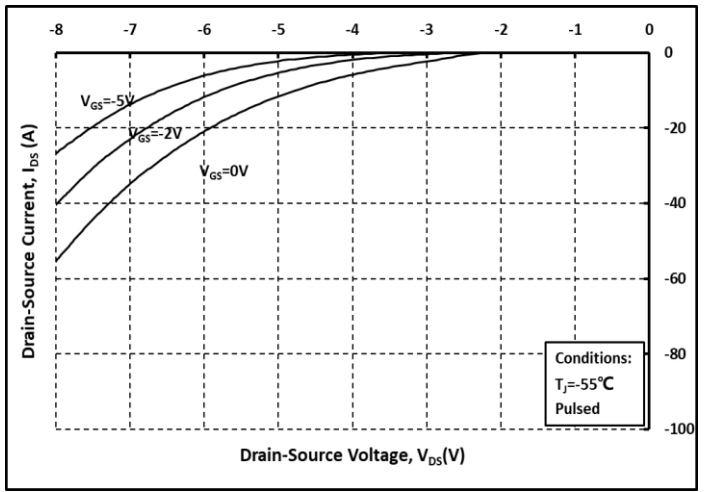


Fig. 10 Body Diode Curves @ $T_J = -55^\circ\text{C}$

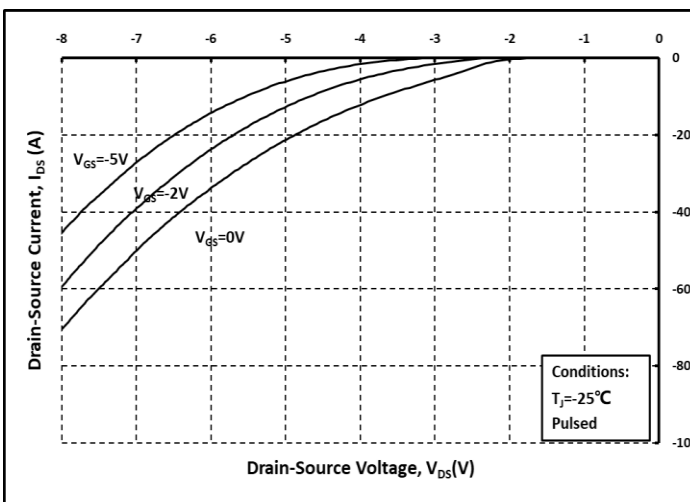


Fig. 11 Body Diode Curves @ $T_J = 25^\circ\text{C}$

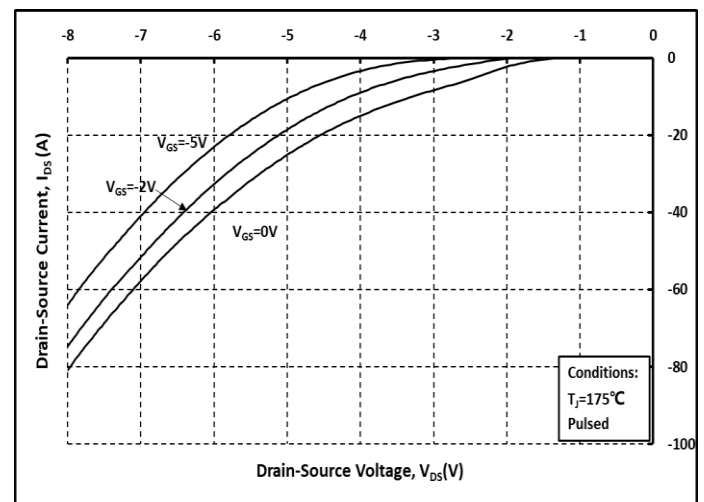


Fig. 12 Body Diode Curves @ $T_J = 175^\circ\text{C}$

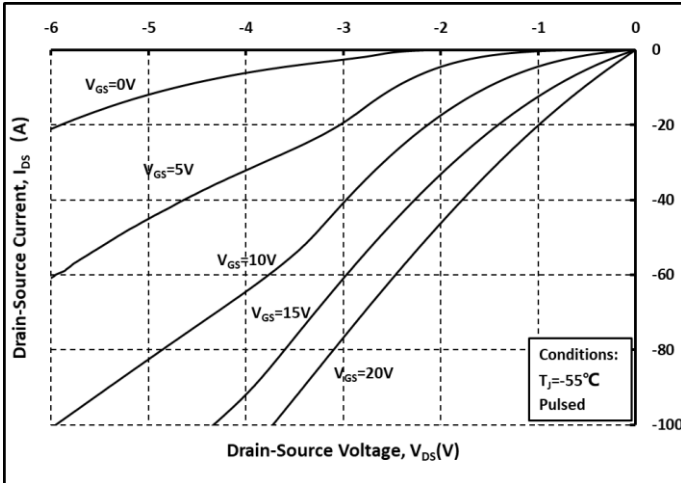


Fig. 13 3rd Quadrant Curves @ $T_j = -55^\circ\text{C}$

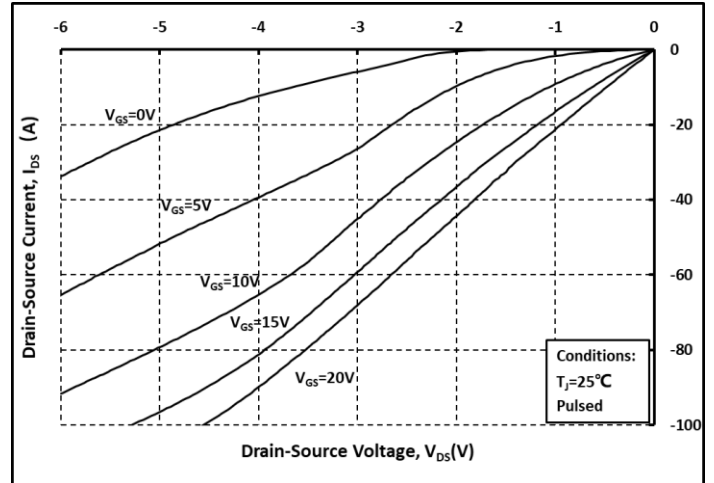


Fig. 14 3rd Quadrant Curves @ $T_j = 25^\circ\text{C}$

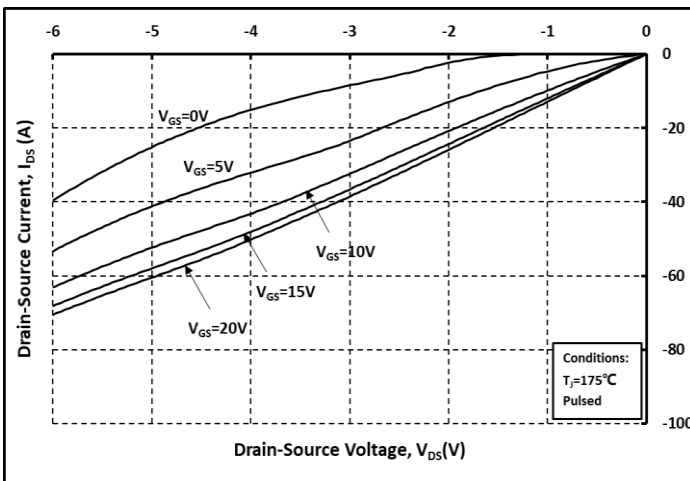


Fig. 15 3rd Quadrant Curves @ $T_j = 175^\circ\text{C}$

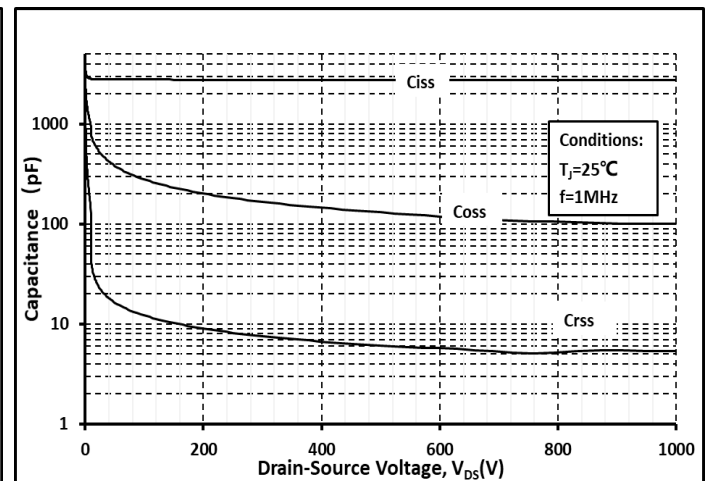


Fig. 16 Capacitance vs. V_{DS}

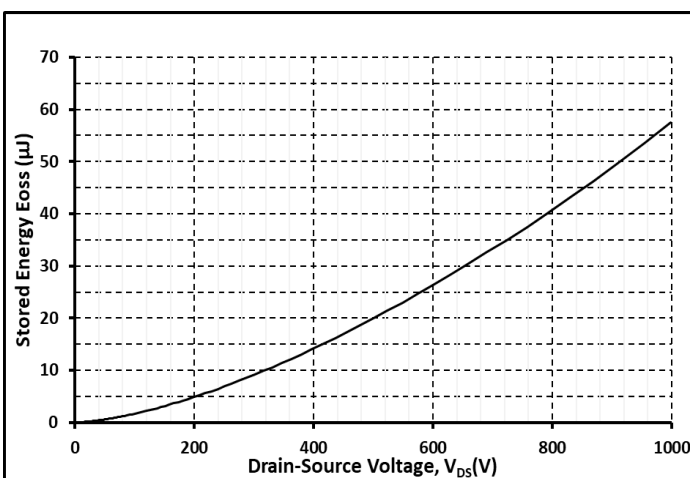


Fig. 17 Output Capacitor Stored Energy

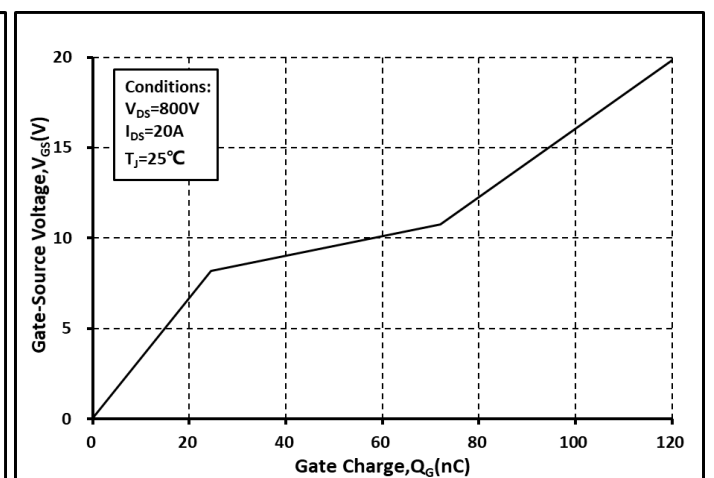


Fig. 18 Gate Charge Characteristics

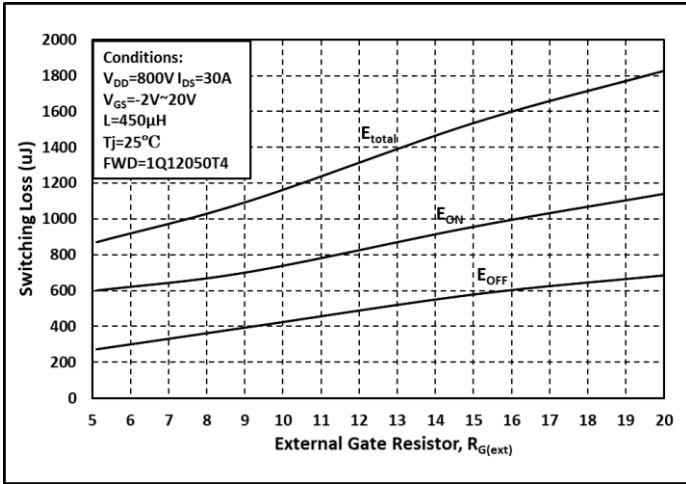


Fig. 19 Switching Energy vs. $R_{G(ext)}$

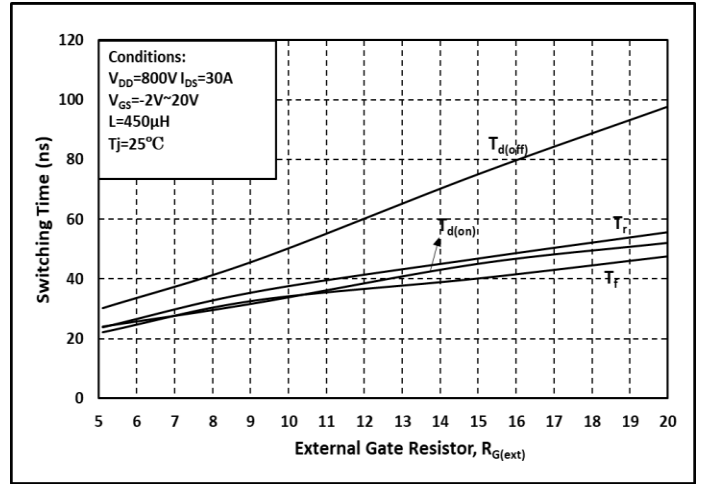


Fig. 20 Switching Times vs. $R_{G(ext)}$

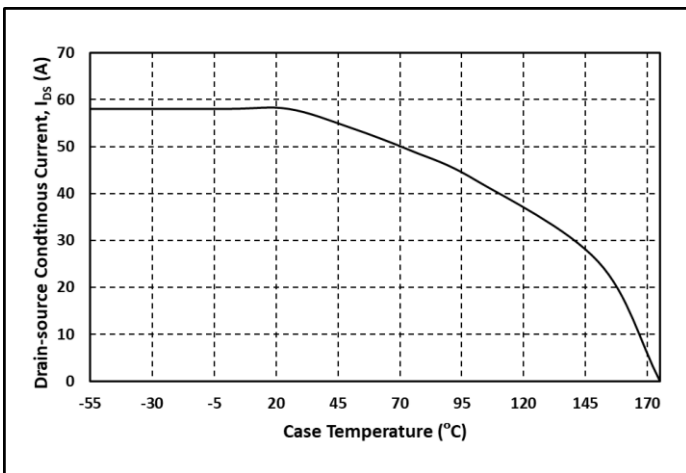


Fig. 21 Continuous Drain Current vs. Case Temperature

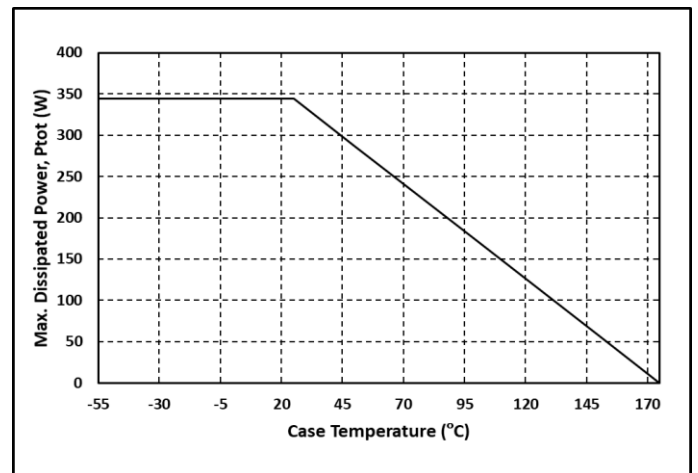


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

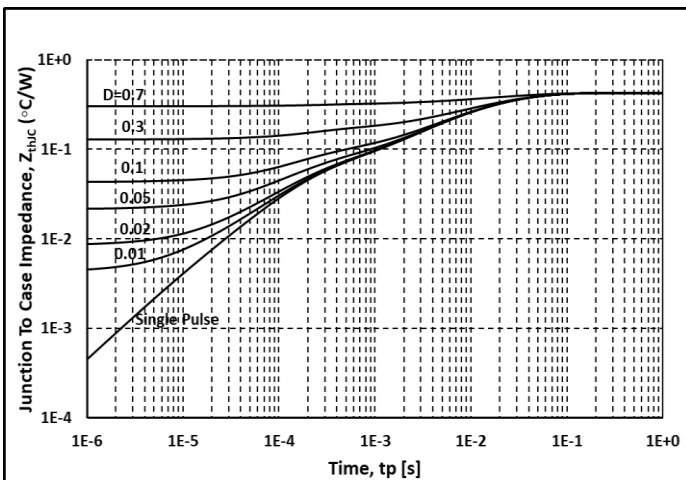


Fig. 23 Thermal Impedance

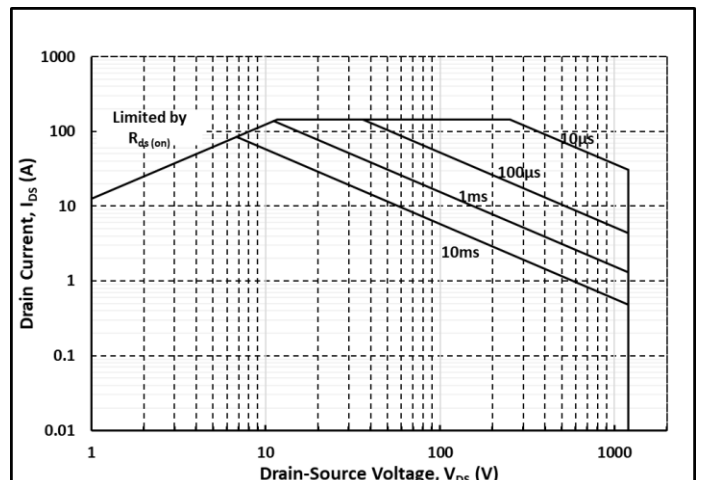
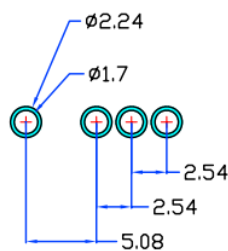
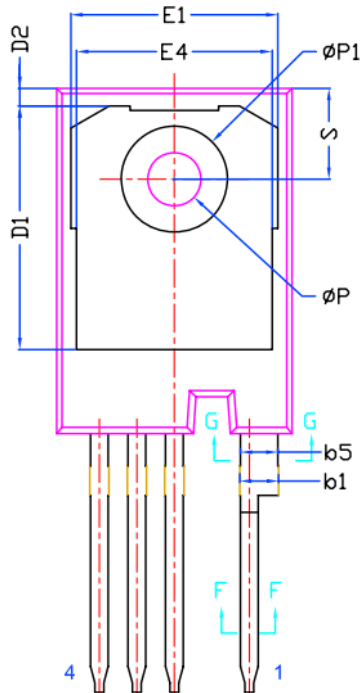
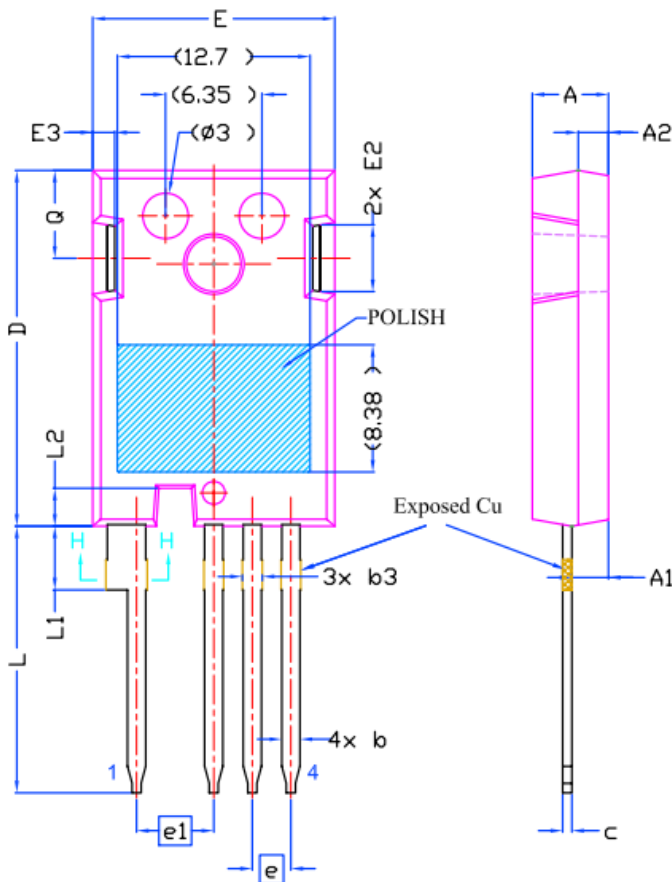


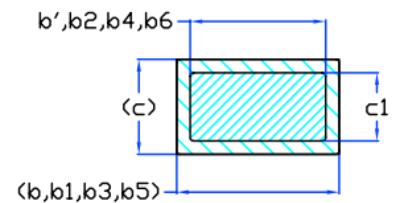
Fig. 24 Safe Operating Area

Package Dimensions



Recommended Solder Pad Layout

| SYMBOL | DIMENSIONS | | |
|--------|------------|-------|-------|
| | MIN. | NOM. | MAX. |
| A | 4.83 | 5.02 | 5.21 |
| A1 | 2.29 | 2.41 | 2.54 |
| A2 | 1.91 | 2.00 | 2.16 |
| b' | 1.07 | 1.20 | 1.28 |
| b | 1.07 | 1.20 | 1.33 |
| b1 | 2.39 | 2.67 | 2.94 |
| b2 | 2.39 | 2.67 | 2.84 |
| b3 | 1.07 | 1.30 | 1.60 |
| b4 | 1.07 | 1.30 | 1.50 |
| b5 | 2.39 | 2.53 | 2.69 |
| b6 | 2.39 | 2.53 | 2.64 |
| c | 0.55 | 0.60 | 0.68 |
| c1 | 0.55 | 0.60 | 0.65 |
| D | 23.30 | 23.45 | 23.60 |
| D1 | 16.25 | 16.55 | 17.65 |
| D2 | 0.95 | 1.19 | 1.25 |
| E | 15.75 | 15.94 | 16.13 |
| E1 | 13.10 | 14.02 | 14.15 |
| E2 | 3.68 | 4.40 | 5.10 |
| E3 | 1.00 | 1.45 | 1.90 |
| E4 | 12.38 | 13.26 | 13.43 |
| e | 2.54 BSC | | |
| e1 | 5.08 BSC | | |
| L | 17.31 | 17.57 | 17.82 |
| L1 | 3.97 | 4.19 | 4.37 |
| L2 | 2.35 | 2.50 | 2.65 |
| øP | 3.51 | 3.61 | 3.65 |
| øP1 | 7.19 REF. | | |
| Q | 5.49 | 5.79 | 6.00 |
| S | 6.04 | 6.17 | 6.30 |



Section F--F, G--G, H--H

Note:

1. Package Reference: JEDEC TO247, Variation AD
2. All Dimensions are in mm
3. Slot Required, Notch May Be Rounded
4. Dimension D&E Do Not Include Mold Flash

Notes

Current revision is preliminary one, for further information please contact IVCT's Office.
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