

Features

- Low $V_{ce(sat)}$, Fast Switching
- $V_{ce(sat)}$ with Positive Temperature Coefficient
- High Ruggedness, Good Thermal Stability
- Very Tight Parameter Distribution
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)

Maximum Ratings

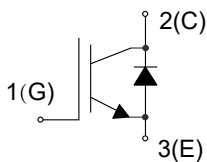
- Operating Junction Temperature Range : -55°C to +175°C
- Storage Temperature Range: -55°C to +175°C
- IGBT Thermal Resistance: 0.6°C/W Junction to Case
- Diode Thermal Resistance: 0.65°C/W Junction to Case
- Thermal Resistance: 40°C/W Junction to Ambient

| Parameter | Symbol | Rating | Unit |
|---|---------------|-------------------------|------|
| Collector-Emitter Voltage | V_{CE} | 650 | V |
| DC Collector Current ⁽¹⁾ | I_C | $T_C=25^\circ\text{C}$ | 80 |
| | | $T_C=100^\circ\text{C}$ | 50 |
| Pulsed Collector Current ⁽²⁾ | $I_{C,pluse}$ | 200 | A |
| Diode Forward Current ⁽¹⁾ | I_F | $T_C=25^\circ\text{C}$ | 40 |
| | | $T_C=100^\circ\text{C}$ | 20 |
| Diode Pulsed Current ⁽²⁾ | $I_{F,pluse}$ | 150 | A |
| Gate-Emitter Voltage | V_{GE} | ± 20 | V |
| Power Dissipation | P_D | $T_C=25^\circ\text{C}$ | 250 |
| | | $T_C=100^\circ\text{C}$ | 100 |

Note:

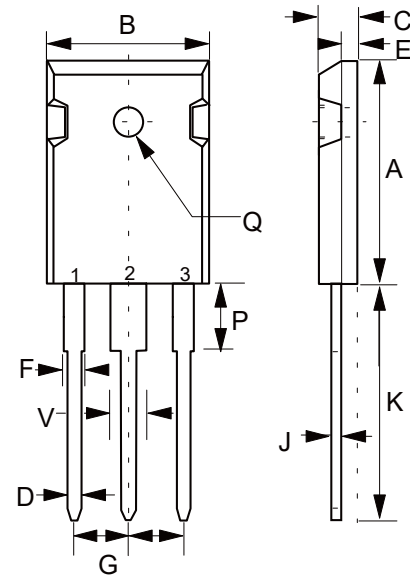
1. Limited by T_{Jmax} .
2. T_p limited by T_{Jmax} .

Internal Structure



Trench and Field Stop IGBT 650V 50A

TO-247



| DIM | DIMENSIONS | | | | NOTE |
|-----|------------|-------|-------|-------|--------|
| | INCHES | | MM | | |
| | MIN | MAX | MIN | MAX | |
| A | 0.815 | 0.839 | 20.70 | 21.30 | |
| B | 0.610 | 0.634 | 15.50 | 16.10 | |
| C | 0.189 | 0.205 | 4.80 | 5.20 | |
| D | 0.043 | 0.055 | 1.10 | 1.40 | |
| E | 0.071 | 0.087 | 1.80 | 2.20 | |
| F | 0.075 | 0.089 | 1.90 | 2.25 | |
| J | 0.020 | 0.030 | 0.50 | 0.75 | |
| K | 0.772 | 0.799 | 19.60 | 20.30 | |
| P | 0.122 | 0.169 | 3.10 | 4.30 | |
| Q | 0.134 | 0.150 | 3.40 | 3.80 | Φ |
| V | 0.106 | 0.134 | 2.70 | 3.40 | |
| G | 0.197 | 0.224 | 5.00 | 5.70 | |

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|--------------------------------------|---------------|---|-----|------|------|------|
| Static Characteristics | | | | | | |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=0.25mA$ | 650 | | | V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=50A$ | | 1.5 | 1.9 | V |
| | | $V_{GE}=15V, I_C=50A, T_J=125^\circ C$ | | 1.85 | | V |
| | | $V_{GE}=15V, I_C=50A, T_J=150^\circ C$ | | 1.95 | | V |
| Diode Forward Voltage | V_F | $V_{GE}=0V, I_F=20A$ | | 1.5 | 1.9 | V |
| | | $V_{GE}=0V, I_F=20A, T_J=125^\circ C$ | | 1.4 | | V |
| | | $V_{GE}=0V, I_F=20A, T_J=150^\circ C$ | | 1.35 | | V |
| G-E Threshold Voltage | $V_{GE(th)}$ | $I_C=1mA, V_{CE}=V_{GE}$ | 4.5 | 5.5 | 6.5 | V |
| C-E Leakage Current | I_{CES} | $V_{CE}=650V, V_{GE}=0V$ | | | 0.01 | mA |
| | | $V_{CE}=650V, V_{GE}=0V, T_J=150^\circ C$ | | | 1 | |
| G-E Leakage Current | I_{GES} | $V_{CE}=0V, V_{GE}=20V$ | | | 250 | nA |
| Transconductance | g_{FS} | $V_{CE}=20V, I_C=50A$ | | 21 | | S |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C_{iss} | $V_{CE}=25V, V_{GE}=0V, f=1MHz$ | | 4579 | | pF |
| Output Capacitance | C_{oss} | | | 192 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 58 | | |
| Gate Charge | Q_g | $V_{CC}=300V, I_C=50A, V_{GE}=15V$ | | 186 | | nC |

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---------------------------------------|--------------|--|-----|------|-----|---------|
| IGBT Switching Characteristics | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CC}=400V, I_C=50A,$ $V_{GE}=0/15V, R_G=10\Omega,$ Inductive load | | 69 | | ns |
| Rise Time | t_r | | | 45 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 404 | | |
| Fall Time | t_f | | | 58 | | |
| Turn-On Energy | E_{on} | | | 1.59 | | mJ |
| Turn-Off Energy | E_{off} | | | 1.34 | | |
| Total Switching Energy | E_{ts} | | | 2.93 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CC}=400V, I_C=50A,$ $V_{GE}=0/15V, R_G=10\Omega, T_J=125^\circ C$ Inductive load | | 66 | | ns |
| Rise Time | t_r | | | 42 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 414 | | |
| Fall Time | t_f | | | 71 | | |
| Turn-On Energy | E_{on} | | | 2.01 | | mJ |
| Turn-Off Energy | E_{off} | | | 1.67 | | |
| Total Switching Energy | E_{ts} | | | 3.68 | | |
| Diode Characteristics | | | | | | |
| Reverse Recovery Time | t_{rr} | $V_R=400V, I_F=20A,$ $di_F/dt=220A/\mu s$ | | 88 | | ns |
| Reverse Recovery Charge | Q_{rr} | | | 0.24 | | μC |
| Peak Reverse Recovery Current | I_{rrm} | | | 6 | | A |
| Reverse Recovery Time | t_{rr} | $V_R=400V, I_F=20A,$ $di_F/dt=220A/\mu s, T_J=125^\circ C$ | | 230 | | ns |
| Reverse Recovery Charge | Q_{rr} | | | 1.05 | | μC |
| Peak Reverse Recovery Current | I_{rrm} | | | 10 | | A |

Curve Characteristics

Fig. 1 - Typical Output Characteristics

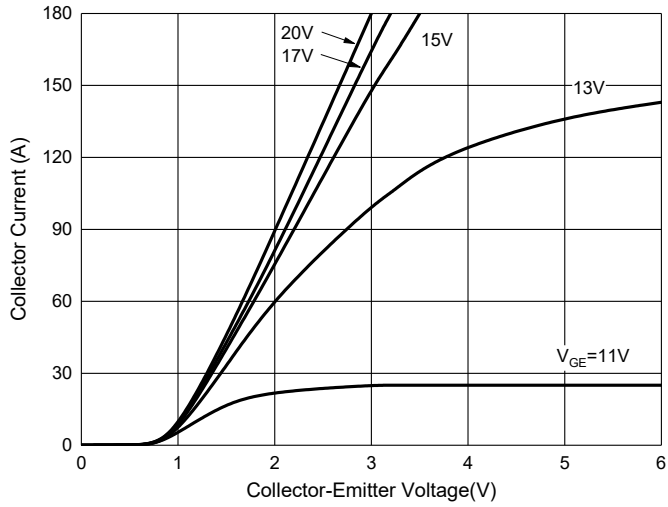


Fig. 2 - Transfer Characteristics

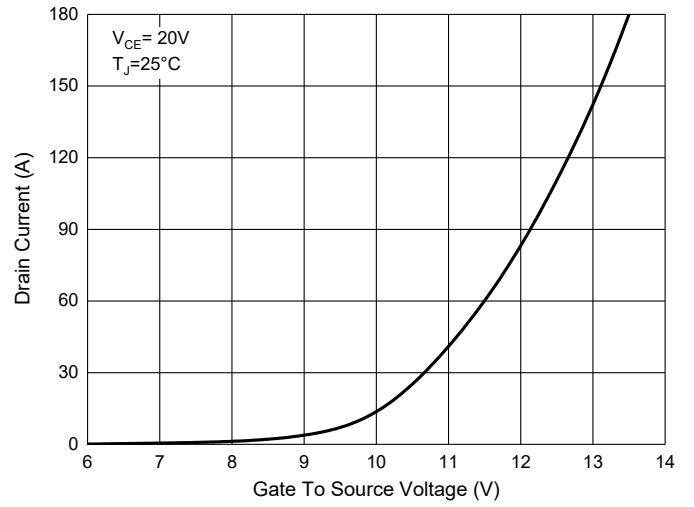


Fig. 3 - Capacitance Characteristics

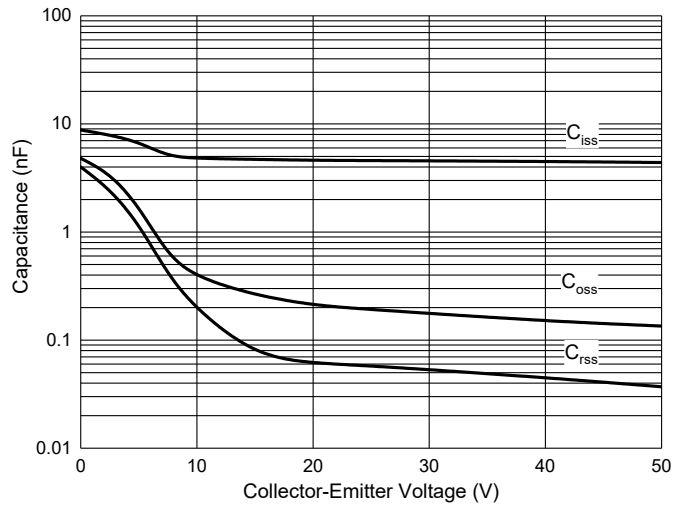


Fig. 4 - Gate Charge

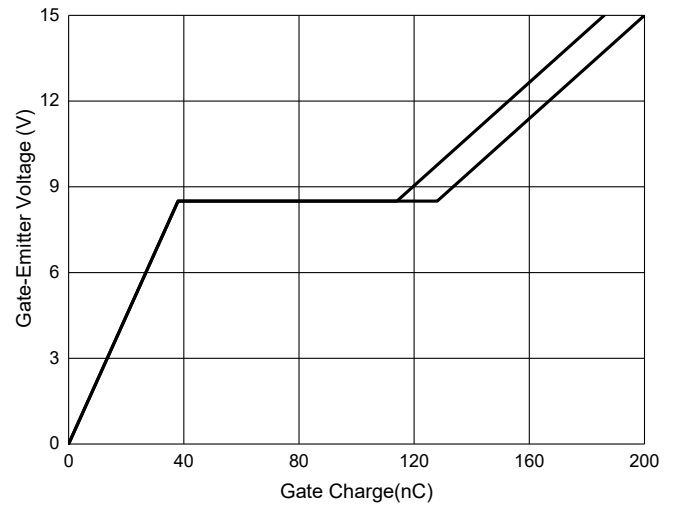


Fig. 5 - Power Derating Curve

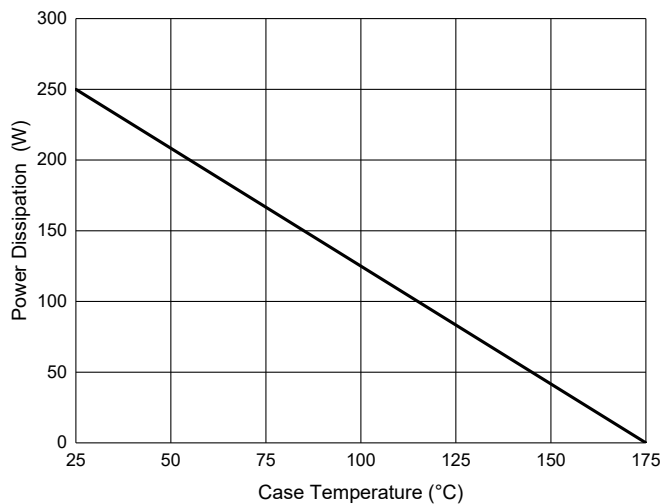
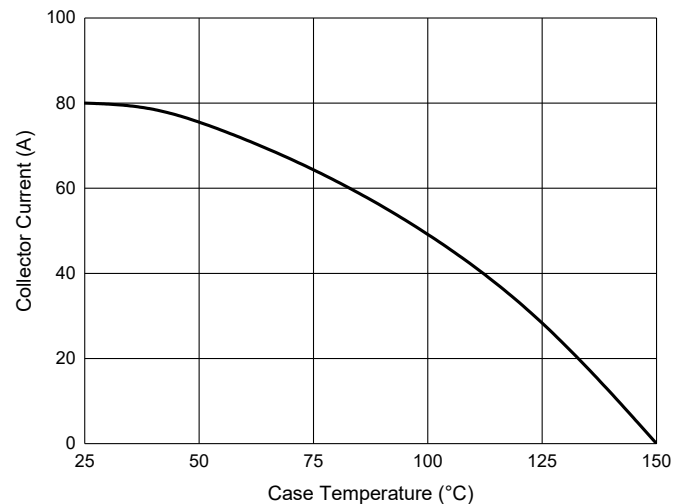


Fig. 6 - Collector Current Derating Curve



Curve Characteristics

Fig. 7 - $V_{CE(sat)} - T_J$

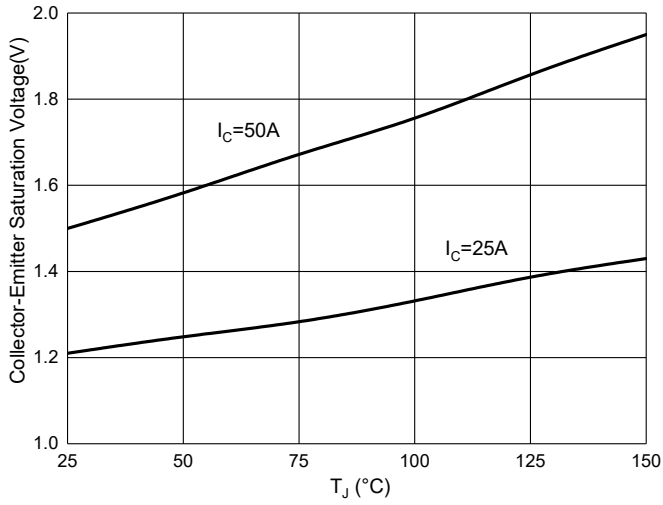


Fig. 8 - $V_{GE(th)} - T_J$

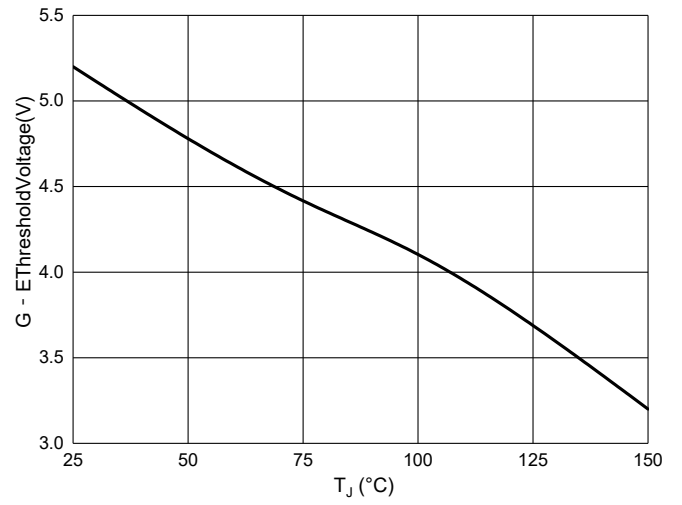


Fig. 9 - $BV_{CES} - T_J$

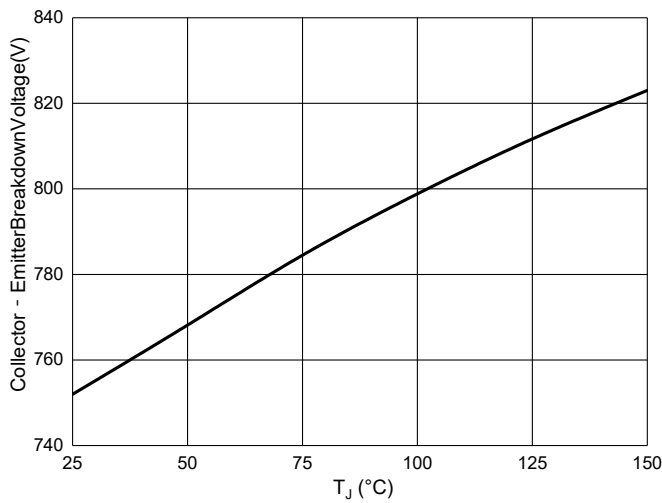


Fig. 10 - $I_{CES} - T_J$

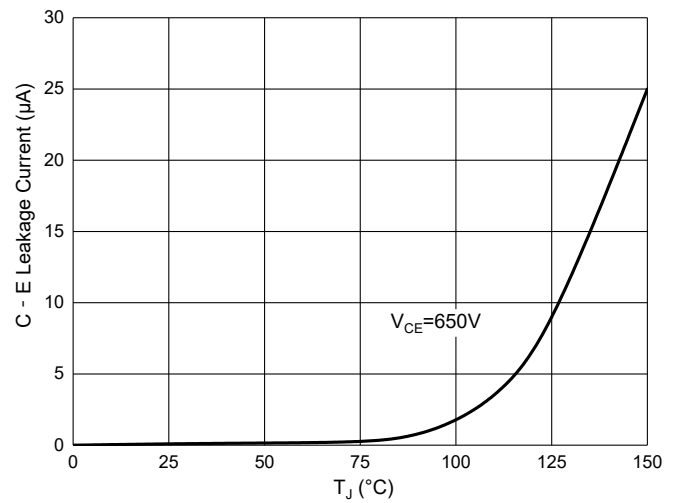


Fig. 11 - Switching Energy Losses - I_C

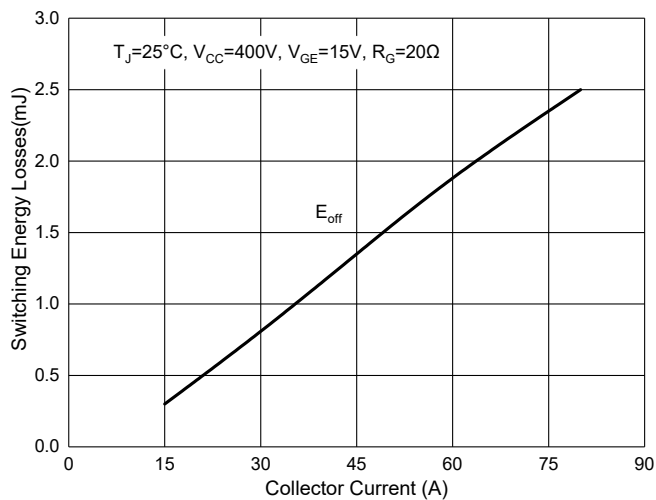
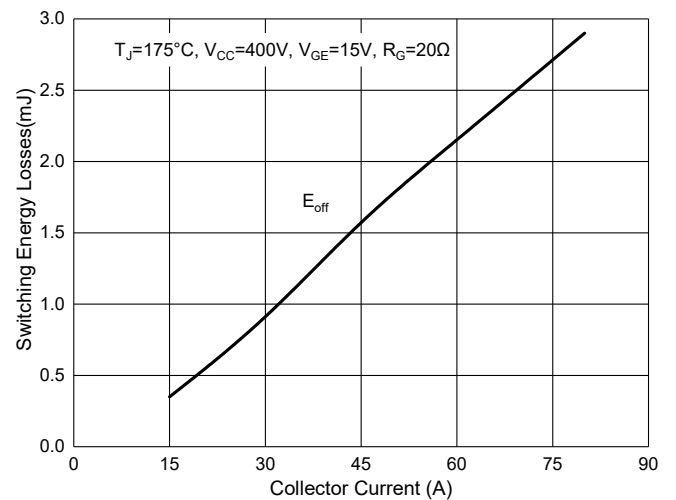


Fig. 12 - Switching Energy Losses - I_C



Curve Characteristics

Fig. 13 - Switching Energy Losses — V_{CE}

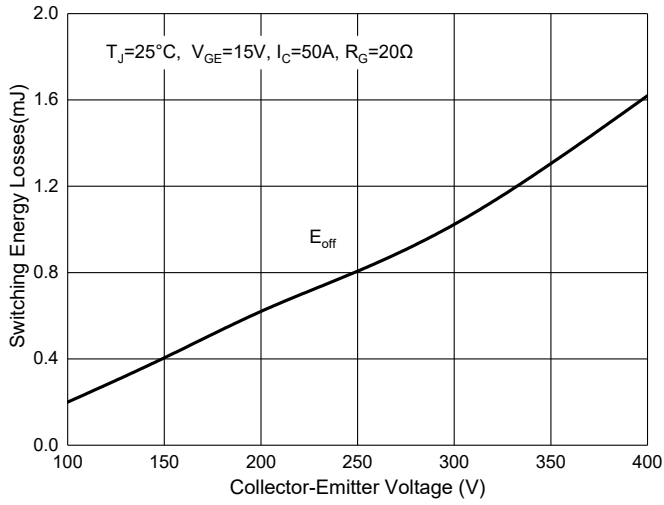


Fig. 14 - Switching Energy Losses — V_{CE}

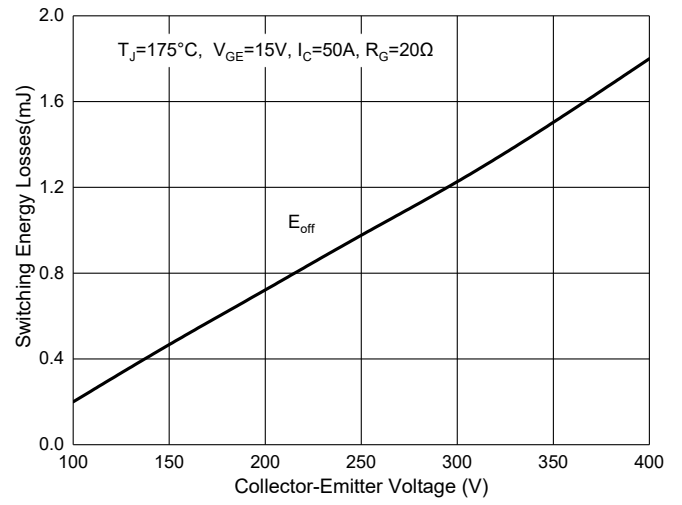
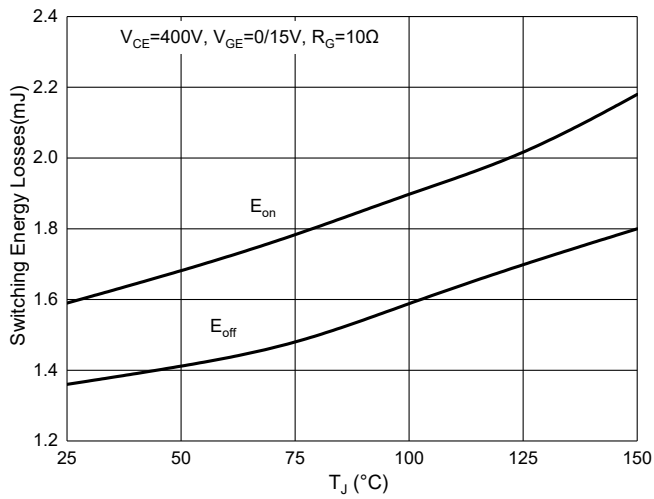


Fig. 15 - Switching Energy Losses — T_J



Ordering Information

| Device | Packing |
|----------------|------------------|
| Part Number-BP | Bulk: 360pcs/Box |

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