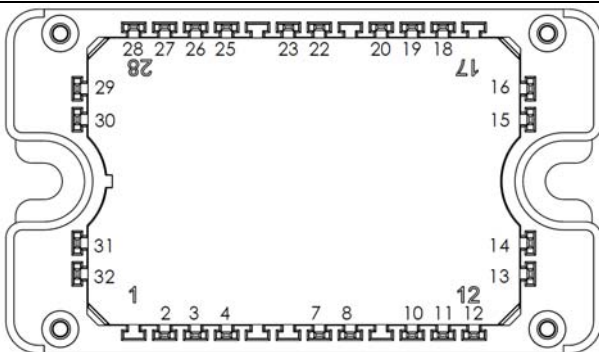
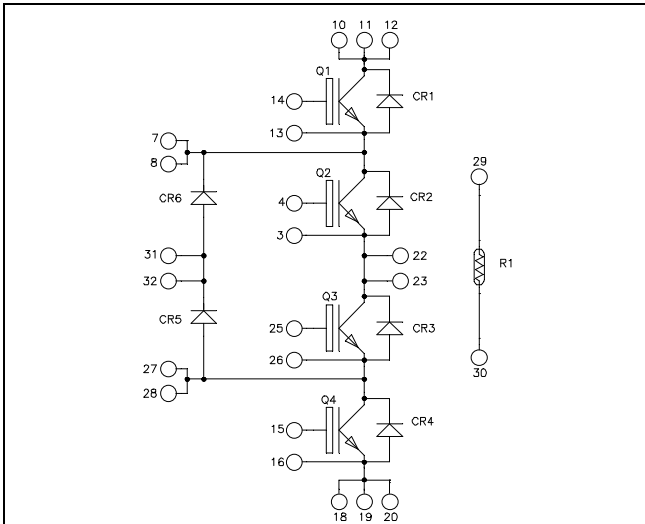


**Three level inverter  
Trench + Field Stop IGBT3  
Power Module**

**$V_{CES} = 600V$   
 $I_C = 100A @ T_c = 80^\circ C$**



All multiple inputs and outputs must be shorted together  
 Example: 10/11/12 ; 7/8 ...

### Application

- Solar converter
- Uninterruptible Power Supplies

### Features

- Trench + Field Stop IGBT3
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 kHz
  - Low leakage current
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- Very low stray inductance
- High level of integration
- Internal thermistor for temperature monitoring

### Benefits

- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Low profile
- RoHS Compliant

**All ratings @  $T_j = 25^\circ C$  unless otherwise specified**

### Q1 to Q4 Absolute maximum ratings (per IGBT)

| Symbol    | Parameter                        | Max ratings         | Unit        |
|-----------|----------------------------------|---------------------|-------------|
| $V_{CES}$ | Collector - Emitter Voltage      | 600                 | V           |
| $I_C$     | Continuous Collector Current     | $T_c = 25^\circ C$  | 150         |
|           |                                  | $T_c = 80^\circ C$  | 100         |
| $I_{CM}$  | Pulsed Collector Current         | $T_c = 25^\circ C$  | 200         |
| $V_{GE}$  | Gate - Emitter Voltage           | $\pm 20$            | V           |
| $P_D$     | Power Dissipation                | $T_c = 25^\circ C$  | 340         |
| RBSOA     | Reverse Bias Safe Operating Area | $T_j = 150^\circ C$ | 200A @ 550V |

 **CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

**Q1 to Q4 Electrical Characteristics (per IGBT)**

| Symbol               | Characteristic                       | Test Conditions   | Min | Typ                    | Max | Unit |   |
|----------------------|--------------------------------------|---|-----|------------------------|-----|------|---|
| I <sub>CES</sub>     | Zero Gate Voltage Collector Current  | V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V                |     |                        | 250 | μA   |   |
| V <sub>CE(sat)</sub> | Collector Emitter Saturation Voltage | V <sub>GE</sub> = 15V<br>I <sub>C</sub> = 100A              |     | T <sub>j</sub> = 25°C  | 1.5 | 1.9  | V |
|                      |                                      |   |     | T <sub>j</sub> = 150°C |     | 1.7  |   |
| V <sub>GE(th)</sub>  | Gate Threshold Voltage               | V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 1.5 mA | 5.0 | 5.8                    | 6.5 | V    |   |
| I <sub>GES</sub>     | Gate – Emitter Leakage Current       | V <sub>GE</sub> = 20V, V <sub>CE</sub> = 0V                 |     |                        | 400 | nA   |   |

**Q1 to Q4 Dynamic Characteristics (per IGBT)**

| Symbol              | Characteristic                      | Test Conditions  | Min | Typ   | Max  | Unit |
|---------------------|-------------------------------------|--|-----|-------|------|------|
| C <sub>ies</sub>    | Input Capacitance                   | V <sub>GE</sub> = 0V<br>V <sub>CE</sub> = 25V<br>f = 1MHz  |     | 6100  |      | pF   |
| C <sub>oes</sub>    | Output Capacitance                  |  |     | 390   |      |      |
| C <sub>res</sub>    | Reverse Transfer Capacitance        |  |     | 190   |      |      |
| Q <sub>G</sub>      | Gate charge                         | V <sub>GE</sub> = ±15V, I <sub>C</sub> = 100A<br>V <sub>CE</sub> = 300V  |     | 1.1   |      | μC   |
| T <sub>d(on)</sub>  | Turn-on Delay Time                  | Inductive Switching (25°C)<br>V <sub>GE</sub> = ±15V<br>V <sub>Bus</sub> = 300V<br>I <sub>C</sub> = 100A<br>R <sub>G</sub> = 3.3Ω  |     | 115   |      | ns   |
| T <sub>r</sub>      | Rise Time                           |  |     | 45    |      |      |
| T <sub>d(off)</sub> | Turn-off Delay Time                 |  |     | 225   |      |      |
| T <sub>f</sub>      | Fall Time                           |  |     | 55    |      |      |
| T <sub>d(on)</sub>  | Turn-on Delay Time                  | Inductive Switching (150°C)<br>V <sub>GE</sub> = ±15V<br>V <sub>Bus</sub> = 300V<br>I <sub>C</sub> = 100A<br>R <sub>G</sub> = 3.3Ω |     | 130   |      | ns   |
| T <sub>r</sub>      | Rise Time                           |  |     | 50    |      |      |
| T <sub>d(off)</sub> | Turn-off Delay Time                 |  |     | 300   |      |      |
| T <sub>f</sub>      | Fall Time                           |  |     | 70    |      |      |
| E <sub>on</sub>     | Turn on Energy                      | V <sub>GE</sub> = ±15V<br>V <sub>Bus</sub> = 300V<br>I <sub>C</sub> = 100A<br>R <sub>G</sub> = 3.3Ω                                |     | 0.875 |      | mJ   |
| E <sub>off</sub>    | Turn off Energy                     |  |     | 3.5   |      | mJ   |
| I <sub>sc</sub>     | Short Circuit data                  | V <sub>GE</sub> ≤ 15V ; V <sub>Bus</sub> = 360V<br>t <sub>p</sub> ≤ 6μs ; T <sub>j</sub> = 150°C                                   |     | 500   |      | A    |
| R <sub>thJC</sub>   | Junction to Case Thermal Resistance |  |     |       | 0.44 | °C/W |

**CR1 to CR4 diode ratings and characteristics (per diode)**

| Symbol            | Characteristic                      | Test Conditions   | Min                    | Typ  | Max  | Unit |
|-------------------|-------------------------------------|---|------------------------|------|------|------|
| V <sub>RRM</sub>  | Peak Repetitive Reverse Voltage     |   |                        |      | 600  | V    |
| I <sub>RM</sub>   | Reverse Leakage Current             | V <sub>R</sub> = 600V   |                        |      | 150  | μA   |
| I <sub>F</sub>    | DC Forward current                  |   |                        | 75   |      | A    |
| V <sub>F</sub>    | Diode Forward Voltage               | I <sub>F</sub> = 75A<br>V <sub>GE</sub> = 0V                      | T <sub>j</sub> = 25°C  | 1.6  | 2    | V    |
|                   |                                     |   | T <sub>j</sub> = 150°C |      | 1.5  |      |
| t <sub>rr</sub>   | Reverse Recovery Time               | I <sub>F</sub> = 75A<br>V <sub>R</sub> = 300V<br>di/dt = 2000A/μs | T <sub>j</sub> = 25°C  | 100  |      | ns   |
|                   |                                     |   | T <sub>j</sub> = 150°C |      | 150  |      |
| Q <sub>rr</sub>   | Reverse Recovery Charge             |   | T <sub>j</sub> = 25°C  | 3.6  |      | μC   |
|                   |                                     |   | T <sub>j</sub> = 150°C |      | 7.6  |      |
| E <sub>rr</sub>   | Reverse Recovery Energy             |   | T <sub>j</sub> = 25°C  | 0.85 |      | mJ   |
|                   |                                     |   | T <sub>j</sub> = 150°C |      | 1.8  |      |
| R <sub>thJC</sub> | Junction to Case Thermal Resistance |   |                        |      | 0.98 | °C/W |

**CR5 & CR6 diode ratings and characteristics (per diode)**

| Symbol            | Characteristic                      | Test Conditions  |                        | Min | Typ | Max  | Unit |
|-------------------|-------------------------------------|--|------------------------|-----|-----|------|------|
| V <sub>RRM</sub>  | Peak Repetitive Reverse Voltage     |  |                        |     |     | 600  | V    |
| I <sub>RM</sub>   | Reverse Leakage Current             | V <sub>R</sub> =600V   |                        |     |     | 150  | μA   |
| I <sub>F</sub>    | DC Forward Current                  | T <sub>c</sub> = 80°C  |                        |     | 100 |      | A    |
| V <sub>F</sub>    | Diode Forward Voltage               | I <sub>F</sub> = 100A<br>V <sub>GE</sub> = 0V                      | T <sub>j</sub> = 25°C  |     | 1.6 | 2    | V    |
|                   |                                     |  | T <sub>j</sub> = 150°C |     | 1.5 |      |      |
| t <sub>rr</sub>   | Reverse Recovery Time               |  | T <sub>j</sub> = 25°C  |     | 125 |      | ns   |
|                   |                                     |  | T <sub>j</sub> = 150°C |     | 220 |      |      |
| Q <sub>rr</sub>   | Reverse Recovery Charge             | I <sub>F</sub> = 100A<br>V <sub>R</sub> = 300V<br>di/dt = 2000A/μs | T <sub>j</sub> = 25°C  |     | 4.7 |      | μC   |
|                   |                                     |  | T <sub>j</sub> = 150°C |     | 9.9 |      |      |
| E <sub>rr</sub>   | Reverse Recovery Energy             |  | T <sub>j</sub> = 25°C  |     | 1.1 |      | mJ   |
|                   |                                     |  | T <sub>j</sub> = 150°C |     | 2.4 |      |      |
| R <sub>thJC</sub> | Junction to Case Thermal Resistance |  |                        |     |     | 0.77 | °C/W |

**Temperature sensor NTC** (see application note APT0406 on www.microsemi.com for more information).

| Symbol                            | Characteristic             | Min | Typ  | Max | Unit |
|-----------------------------------|----------------------------|-----|------|-----|------|
| R <sub>25</sub>                   | Resistance @ 25°C          |     | 50   |     | kΩ   |
| ΔR <sub>25</sub> /R <sub>25</sub> |                            |     | 5    |     | %    |
| B <sub>25/85</sub>                | T <sub>25</sub> = 298.15 K |     | 3952 |     | K    |
| ΔB/B                              | T <sub>C</sub> = 100°C     |     | 4    |     | %    |

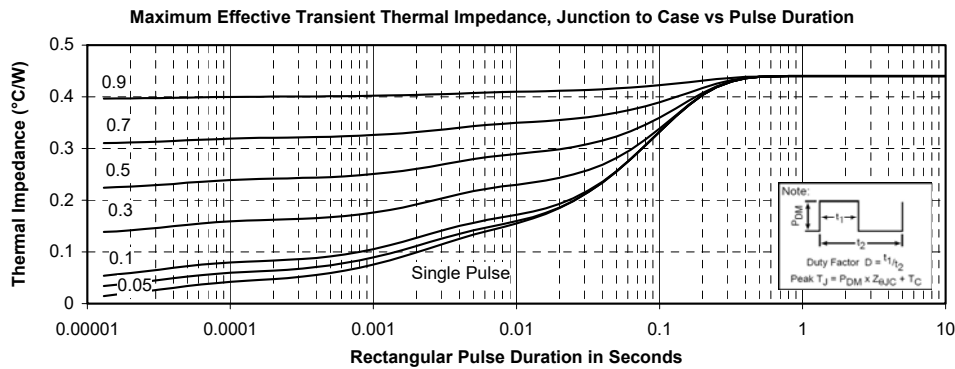
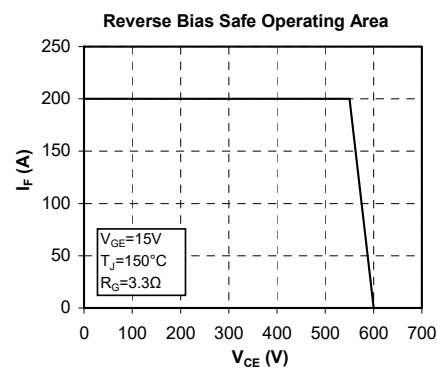
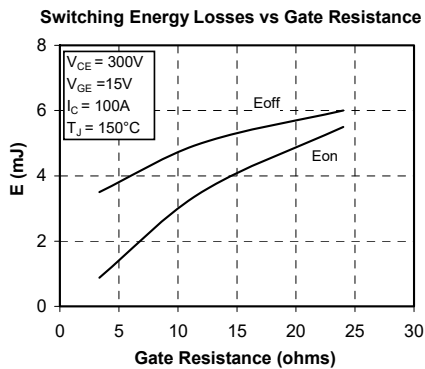
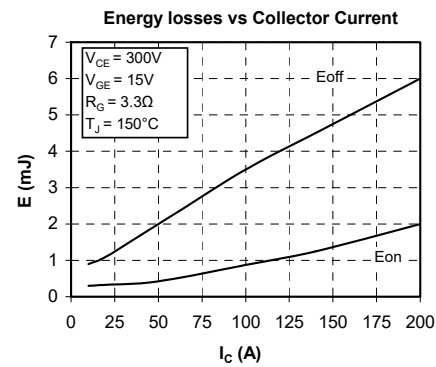
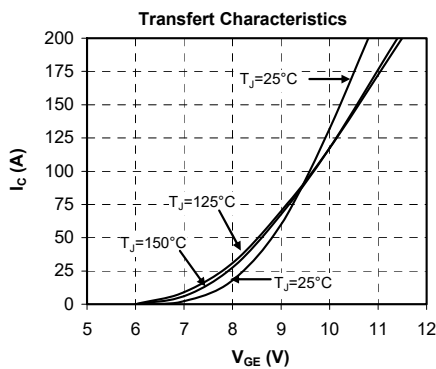
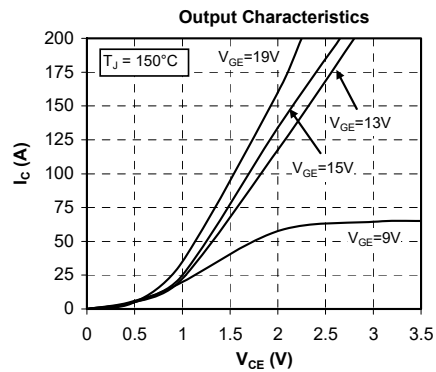
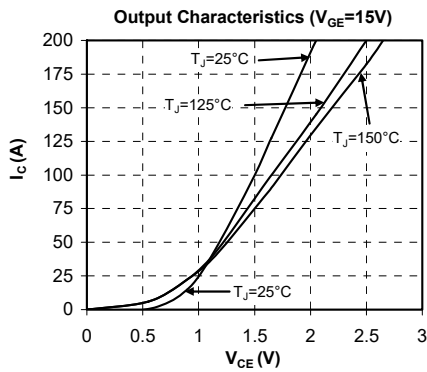
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

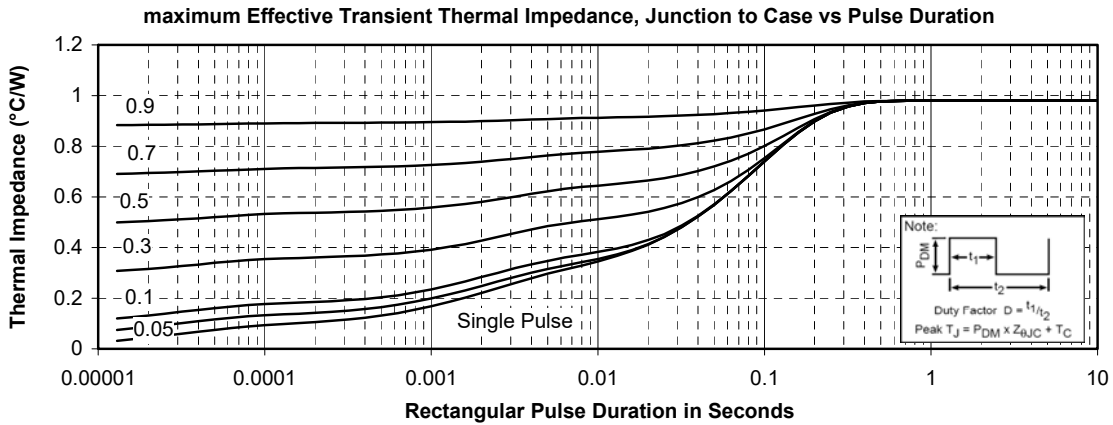
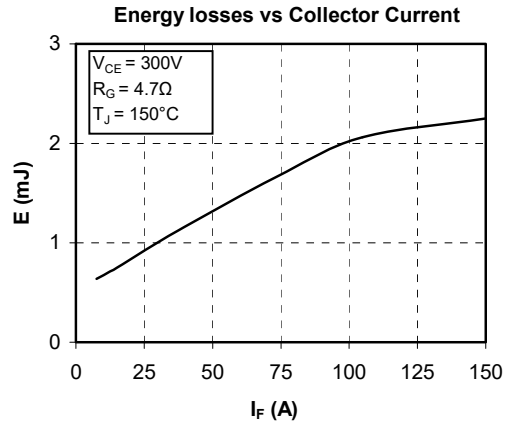
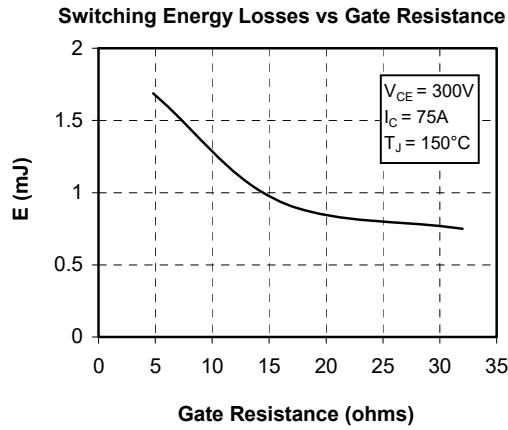
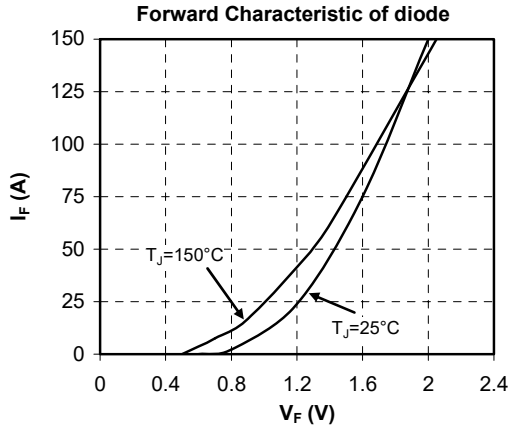
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

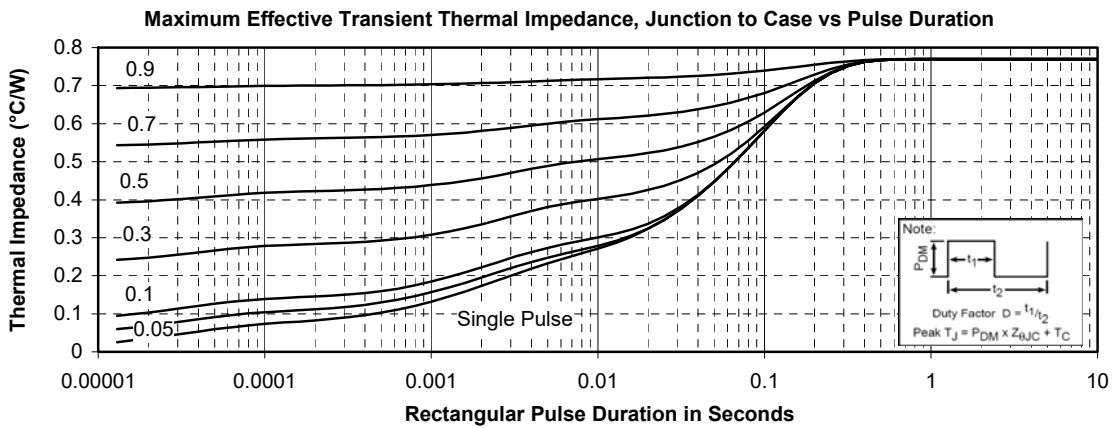
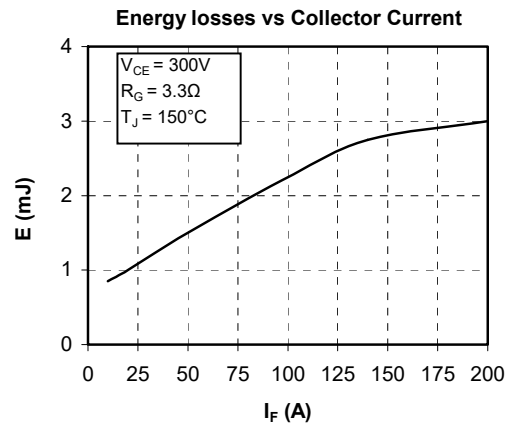
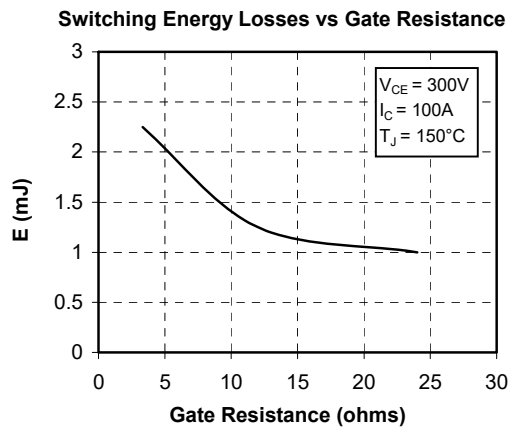
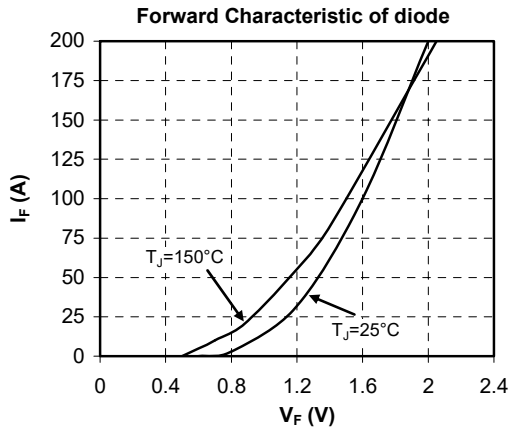
**Thermal and package characteristics**

| Symbol            | Characteristic   | Min         | Max                   | Unit |     |     |
|-------------------|--|-------------|-----------------------|------|-----|-----|
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal to case t = 1 min, 50/60Hz | 4000        |                       | V    |     |     |
| T <sub>J</sub>    | Operating junction temperature range                           | -40         | 175                   | °C   |     |     |
| T <sub>JOP</sub>  | Recommended junction temperature under switching conditions    | -40         | T <sub>Jmax</sub> -25 |      |     |     |
| T <sub>STG</sub>  | Storage Temperature Range                                      | -40         | 125                   |      |     |     |
| T <sub>C</sub>    | Operating Case Temperature                                     | -40         | 125                   |      |     |     |
| Torque            | Mounting torque  | To heatsink | M4                    | 2    | 3   | N.m |
| Wt                | Package Weight   |             |                       |      | 110 | g   |





**CR1 to CR4 Typical performance curve**


**CR5 & CR6 Typical performance curve**


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