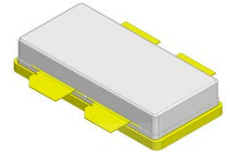


Product Features

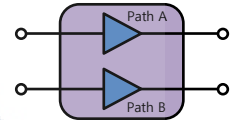
- 1805~1880MHz
- 330W Saturated Power @ 48V
- 57% Drain Efficiency @ 48dBm
- Internally Matched
- Symmetrical Doherty GaN HEMT

Applications

- WiMAX, LTE, WCDMA, GSM
- Multi-Band, Multi-Mode
- Multi-Carrier
- High Efficiency, Doherty Amplifier



Package Type : RF24001DKR3



Typical Single-Carrier LTE Performance $(V_{DS} = +48V, T_C = 25^\circ C, 50\Omega)$

| Frequency [MHz] | Peak Power | Average Power ^{*1} | | | |
|-----------------|------------|-----------------------------|-----------|----------------------|------------|
| | Power [W] | Power [W] | Gain [dB] | Drain Efficiency [%] | ACLR [dBc] |
| 1810.0 | 353.2 | 63 | 16.0 | 56.9 | -24.2 |
| 1842.5 | 352.4 | 63 | 15.5 | 57.7 | -25.2 |
| 1875.0 | 341.2 | 63 | 15.2 | 56.2 | -26.4 |

Note

*1 Measured in the IE18330D Doherty test board amplifier circuit, under LTE 10MHz, PAR 7.5dB @0.01% probability on CCDF.

Absolute Maximum Ratings

| Rating | Symbol | Value | Unit | Condition |
|--|-----------|-----------|------------|--------------------|
| Drain to Source Voltage | V_{DSS} | 150 | V | $T_C = 25^\circ C$ |
| Gate to Source Voltage | V_{GS} | -10, +2 | V | $T_C = 25^\circ C$ |
| Operating Voltage | V_{DD} | 52 | V_{DC} | - |
| Storage Temperature | T_{STG} | -65, +150 | $^\circ C$ | - |
| Case Operating Temperature | T_C | -40, +150 | $^\circ C$ | 30 seconds |
| Operating Junction Temperature ^{*1} | T_J | 225 | $^\circ C$ | - |
| Soldering Temperature ^{*2} | T_S | 245 | $^\circ C$ | - |

Note

*1 Continuous use at maximum temperature will affect MTF.

*2 Refer to the Application Note(AN-002) on soldering - "Solder Condition for RFHIC's GaN Device"

Thermal Characteristics

| Rating | Symbol | Value | Unit | Condition |
|--------------------------------------|-----------------|--------------------|--------------|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.65 ^{*1} | $^\circ C/W$ | $T_C = 85^\circ C$ |

Note

*1 Measured for the IE18330D at dissipation power of 84.8W.

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

| Characteristics | Conditions | Symbol | Min | Typ | Max | Unit |
|---|--------------------------|--------------|------|------|------|----------|
| DC Characteristics - Path A (Carrier)^{*1} | | | | | | |
| Maximum Forward Gate Current | $T_C = 25^\circ\text{C}$ | I_{GMAX} | - | - | 24.0 | mA |
| Maximum Drain Current ^{*2} | $T_C = 25^\circ\text{C}$ | I_{DMAX} | - | - | 9.0 | A |
| Power Dissipation | $T_C = 85^\circ\text{C}$ | P_{DMAX} | - | - | 84.8 | W |
| Gate Threshold Voltage | $V_{DS} = 10\text{V}$ | $V_{GS(TH)}$ | -3.8 | -3.0 | -2.3 | V_{DC} |
| | $I_D = 21.6\text{mA}$ | | | | | |
| Gate Quiescent Voltage | $V_{DS} = 48\text{V}$ | $V_{GS(Q)}$ | - | -2.7 | - | V_{DC} |
| | $I_D = 750\text{mA}$ | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS} = -8\text{V}$ | V_{BR} | 150 | - | - | V |
| | $I_D = 21.6\text{mA}$ | | | | | |
| Saturated Drain Current ^{*3} | $V_{DS} = 6\text{V}$ | I_{DS} | 18.0 | 21.6 | - | A |
| | $V_{GS} = 2\text{V}$ | | | | | |
| Gate Leakage Current | $V_{GS} = -8\text{V}$ | I_{GLKG} | -4.8 | - | - | mA |
| | $V_{DS} = 120\text{V}$ | | | | | |
| Drain Leakage Current | $V_{GS} = -8\text{V}$ | I_{DLKG} | - | - | 8.6 | mA |
| | $V_{DS} = 120\text{V}$ | | | | | |
| DC Characteristics - Path B (Peaking)^{*1} | | | | | | |
| Maximum Forward Gate Current | $T_C = 25^\circ\text{C}$ | I_{GMAX} | - | - | 24.0 | mA |
| Maximum Drain Current ^{*2} | $T_C = 25^\circ\text{C}$ | I_{DMAX} | - | - | 9.0 | A |
| Power Dissipation | $T_C = 85^\circ\text{C}$ | P_{DMAX} | - | - | 84.8 | W |
| Gate Threshold Voltage | $V_{DS} = 10\text{V}$ | $V_{GS(TH)}$ | -3.8 | -3.0 | -2.3 | V_{DC} |
| | $I_D = 21.6\text{mA}$ | | | | | |
| Gate Quiescent Voltage | $V_{DS} = 48\text{V}$ | $V_{GS(Q)}$ | - | -2.7 | - | V_{DC} |
| | $I_D = 750\text{mA}$ | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS} = -8\text{V}$ | V_{BR} | 150 | - | - | V |
| | $I_D = 21.6\text{mA}$ | | | | | |
| Saturated Drain Current ^{*3} | $V_{DS} = 6\text{V}$ | I_{DS} | 18.0 | 21.6 | - | A |
| | $V_{GS} = 2\text{V}$ | | | | | |
| Gate Leakage Current | $V_{GS} = -8\text{V}$ | I_{GLKG} | -4.8 | - | - | mA |
| | $V_{DS} = 120\text{V}$ | | | | | |
| Drain Leakage Current | $V_{GS} = -8\text{V}$ | I_{DLKG} | - | - | 8.6 | mA |
| | $V_{DS} = 120\text{V}$ | | | | | |

Note

*1 Measured on wafer prior to packaging.

*2 Current Limit for long term, reliable operation.

*3 Scaled from PCM data.

| Characteristics | Conditions | Symbol | Min | Typ | Max | Unit |
|---|--|------------------|------|-------|-------|------|
| RF Characteristics (Fc=1842.5MHz unless otherwise noted) | | | | | | |
| Saturated Output Power ^{*1,4} | V _{DS} = 48V | P _{SAT} | | 330 | - | W |
| | I _{DQ} = 750mA | | | | | |
| Modulated Gain ^{*2} | V _{DS} = 48V | G _{BR} | 14.0 | 15.0 | - | dB |
| | I _{DQ} = 750mA | | | | | |
| | P _{OUT} = 48dBm | | | | | |
| LTE Linearity ^{*2} | V _{DS} = 48V | ACLR | - | -25.0 | -23.0 | dBc |
| | I _{DQ} = 750mA | | | | | |
| | P _{OUT} = 48dBm | | | | | |
| Modulated Drain Efficiency ^{*2} | V _{DS} = 48V | η | 55.0 | 57.0 | - | % |
| | I _{DQ} = 750mA | | | | | |
| | P _{OUT} = 48dBm | | | | | |
| Output Mismatch Stress ^{*1,3} | V _{DS} = 48V | VSWR | - | - | 10:1 | ψ |
| | I _{DQ} = 750mA | | | | | |
| | P _{OUT} = P _{SAT} Pulsed | | | | | |

Note

*1 Pulse width 100μsec, Duty Cycle 10%.

*2 Measured in the IE18330D Doherty test board amplifier circuit, under LTE 10MHz, PAR7.5dB @0.01% probability on CCDF.

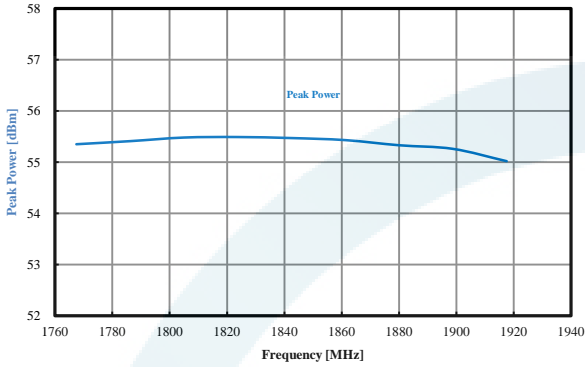
*3 Measured in the IE18330D Doherty test board amplifier circuit. No damage at all phase angles.

*4 Psat is defined as $\Delta P_{out}/\Delta P_{in} < 0.1$, where ΔP_{in} is increased input power, ΔP_{out} is increased output power.

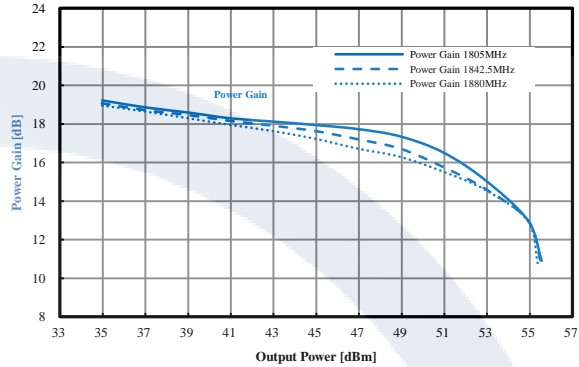
www.rfhic.com

Typical Pulsed Signal Performance (Tc=25°C, Measured in the IE18330D test board amplifier circuit)

Peak Power vs. Frequency



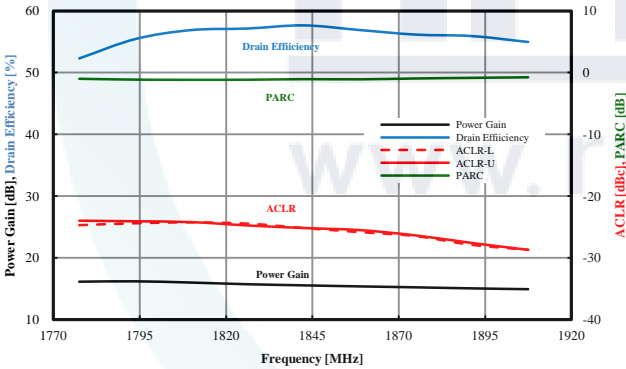
Pulsed Power Gain vs. Output Power



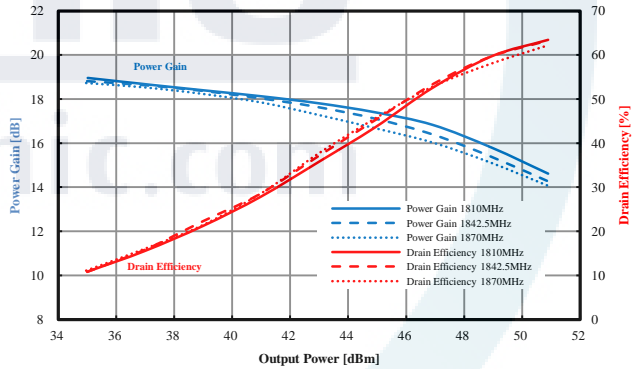
V_{DS} = 48V, I_{DQ(C)} = 750mA, V_{GS(P)} = -4.5V, Pulse Width = 100µsec, Duty Cycle = 10%

Typical LTE Signal Performance (Tc=25°C, Measured in the IE18330D test board amplifier circuit)

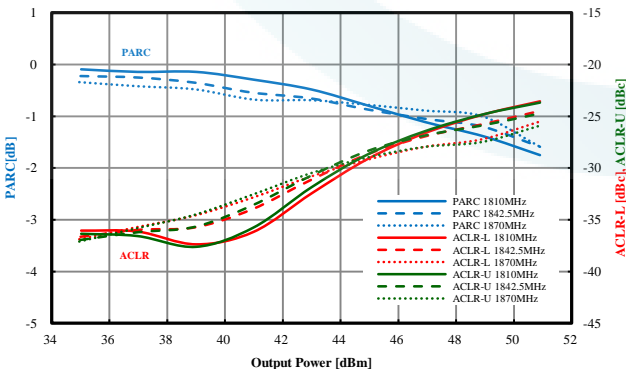
LTE Power Gain, Drain Efficiency, ACLR, PARC vs. Frequency



Power Gain, Drain Efficiency vs. Output Power



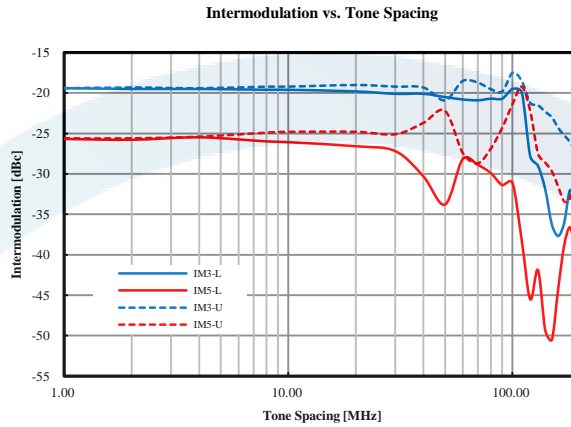
PARC, ACLR vs. Output Power



P_{AVG} = 48dBm, V_{DS} = 48V, I_{DQ(C)} = 750mA, V_{GS(P)} = -4.5V
 LTE 10MHz BW, PAPR=7.5dB @ 0.01% Probability on CCDF

Typical 2-tone Intermodulation Imbalance Performance

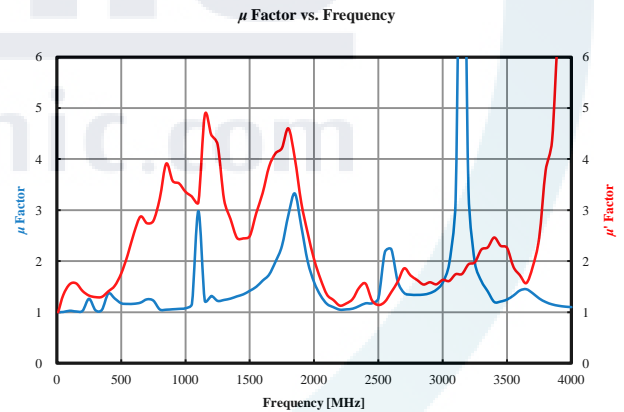
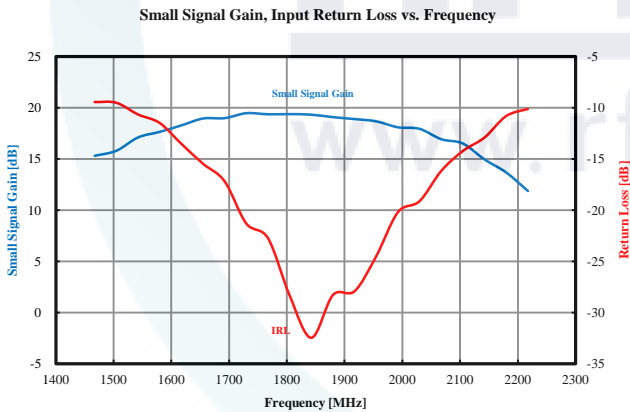
(Tc=25 °C, Measured in the IE18330D Doherty test board amplifier circuit)



2-tone Power = 53.2dBm, $V_{DS} = 48V$, $I_{DQ(C)} = 750mA$, $V_{GS(P)} = -4.5V$

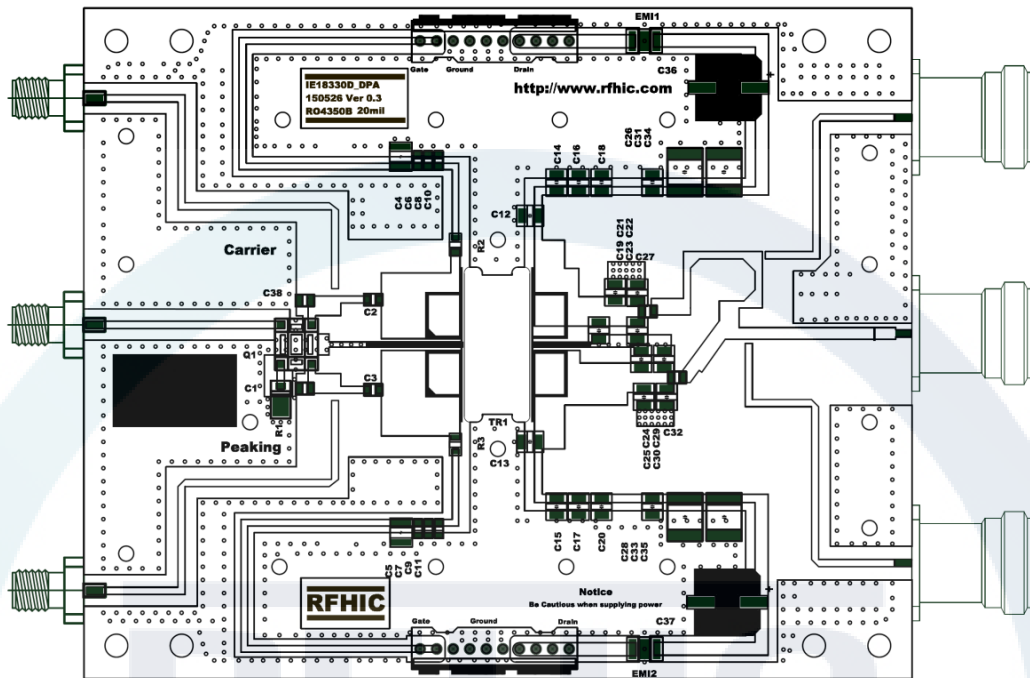
Typical Small Signal Performance

(Tc=25 °C, Measured in the IE18330D Doherty test board amplifier circuit)



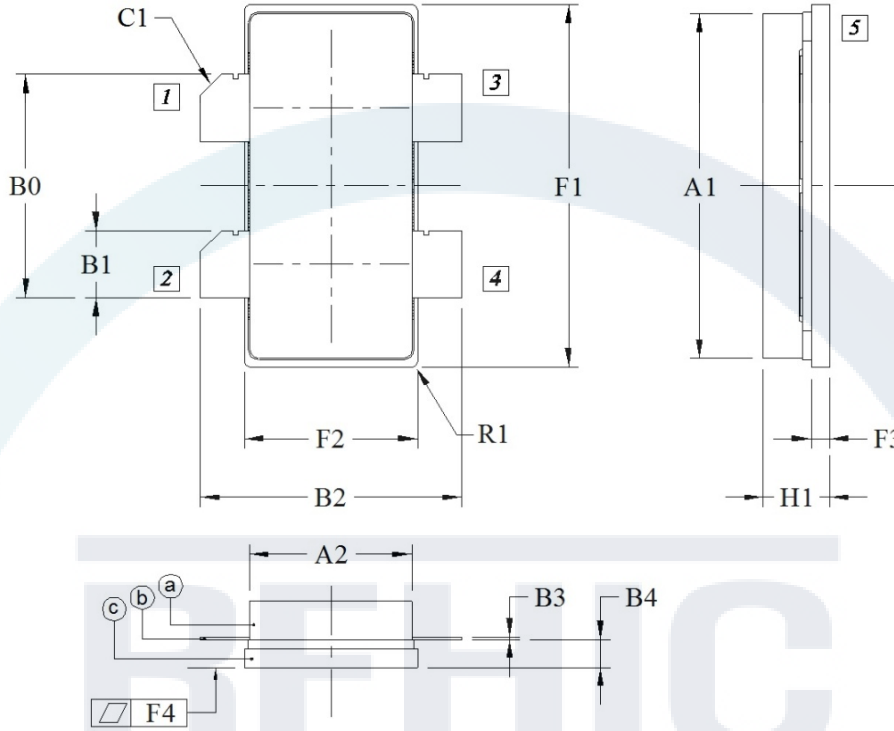
$P_{IN} = 0dBm$, $V_{DS} = 48V$, $I_{DQ} = 750mA$, $V_{GS(P)} = -4.5V$

Test Board Component Layout



| Part | Description | Part Number | Manufacturer |
|--------------------|---|--------------------|--------------|
| R1 | 50 ohm Power Resistor | 45-0040S | DICONEX |
| R2, R3 | 10 ohm Chip Resistor | MCR10EZPJ100 | ROHM |
| C1 | 1.5pF High Q Capacitor | 201CHA1R5CSLE | TEMEX |
| C2,C32 | 15pF High Q Capacitor | 201CHA150JSLE | TEMEX |
| C3 | 100pF High Q Capacitor | 201CHA101JSLE | TEMEX |
| C4,C5 | 10uF Polymer Capacitor | TCJA106M016R0200 | AVX |
| C6,C7 | 10nF Chip Capacitor | GRM188R71H103KA01D | MURATA |
| C8,C9 | 1nF Chip Capacitor | GRM188R71H102KA01D | MURATA |
| C10,C11 | 100pF Chip Capacitor | GRM1885C1H101JA01D | MURATA |
| C12,C13,C19 | 0.5pF High Q Capacitor | 201CHB0R5BSLE | TEMEX |
| C14, C15 | 10pF High Q Capacitor | 201CHB100JSLE | TEMEX |
| C16,C17,C21,C24,C2 | - | - | - |
| C18,C20 | 100pF High Q Capacitor | 201CHB101JSLE | TEMEX |
| C22,C23 | 1.0pF High Q Capacitor | 201CHB1R0BSLE | TEMEX |
| C26,C28 | 1000pF High Q Capacitor | 201CHB102JSLE | TEMEX |
| C27 | 5.1pF High Q Capacitor | 201CHA5R1CSLE | TEMEX |
| C30 | 0.3pF High Q Capacitor | 201CHB0R3BSLE | TEMEX |
| C31,C33,C34,C35 | 10uF MLCC | RS80R2A106M | MARUWA |
| C36,C37 | 33uF Aluminum Capacitor | BDS100VC33MJ10TP | SAMYOUNG |
| C38 | 0.5pF High Q Capacitor | 201CHA0R5BSLE | TEMEX |
| Q1 | Hybrid Coupler | CMX19Q02 | RN2 |
| EMI1, EMI2 | EMI FILTER | CTH32R102S20A-TM | MARUWA |
| CON1, CON2 | DC Connector | 22-04-1101 | MOLEX |
| PCB | $\epsilon_r=3.66 \pm 0.05$, 0.020" (0.508mm) | RO4350B | ROGERS Corp. |
| TR1 | 330W GaN Transistor | IE18330D | RFHIC |

Package Dimensions (Type:RF24001DKR3)



| Pin Description | |
|-----------------|--------------|
| Pin No | Function |
| 1 | Path A Gate |
| 2 | Path B Gate |
| 3 | Path A Drain |
| 4 | Path B Drain |
| 5 | Source |

- Ⓐ- Lid
- Ⓑ- Lead Frame
- Ⓒ- Flange

| Dim. | INCH | | | MILLIMETER | | |
|--------------|-------|-------|-------|------------|-------|-------|
| | MIN | TYP | MAX | MIN | TYP | MAX |
| A1 | 0.767 | 0.772 | 0.777 | 19.48 | 19.61 | 19.74 |
| A2 | 0.357 | 0.362 | 0.367 | 9.07 | 9.2 | 9.33 |
| B0 | 0.495 | 0.5 | 0.505 | 12.57 | 12.7 | 12.83 |
| B1 | 0.145 | 0.15 | 0.155 | 3.68 | 3.81 | 3.94 |
| B2 | 0.58 | 0.584 | 0.589 | 14.72 | 14.84 | 14.97 |
| B3 | 0.003 | 0.005 | 0.007 | 0.08 | 0.13 | 0.18 |
| B4 | 0.057 | 0.062 | 0.067 | 1.44 | 1.57 | 1.7 |
| C1 (Chamfer) | 0.042 | 0.047 | 0.052 | 1.07 | 1.2 | 1.33 |
| F1 | 0.806 | 0.811 | 0.816 | 20.47 | 20.6 | 20.73 |
| F2 | 0.381 | 0.386 | 0.391 | 9.67 | 9.8 | 9.93 |
| F3 | 0.031 | 0.036 | 0.041 | 0.79 | 0.92 | 1.05 |
| F4 | - | 0.002 | - | - | 0.04 | - |
| H1 | 0.127 | 0.148 | 0.17 | 3.22 | 3.77 | 4.32 |
| R1 (Radius) | 0.022 | 0.026 | 0.03 | 0.55 | 0.65 | 0.75 |

Revision History

| Part Number | Release Date | Version | Description | Data Sheet Status |
|-------------|--------------|---------|-------------------------------------|-------------------|
| IE18330D | March, 2016 | 1.0 | Modified Electrical Characteristics | - |
| | | | | |
| | | | | |



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