iT5082
12.5 Gb/s Modulator Driver Amplifier

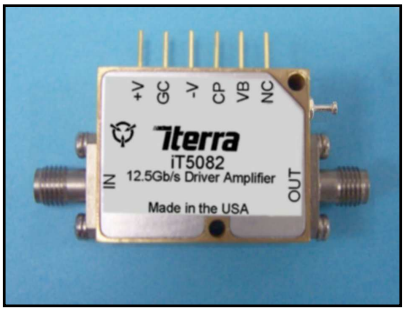
Description

The iT5082 is general-purpose modulator driver designed for NRZ communication systems operating up to 12.5 Gb/s. The driver is typically used to amplify a data signal between a MUX and an optical modulator. With its wide output amplitude adjustment range, the iT5082 is capable of driving Electro Absorption (EA), semiconductor Mach-Zehnder, and $LiNbO_3$ modulators. Additional features include eye cross point adjustability, internal power sequencing circuitry and filtering, a bias port to apply a DC level to the output port, and the ability to apply a dither tone to amplitude-modulate the output data. This feature is critical for traditional modulator bias control loops.

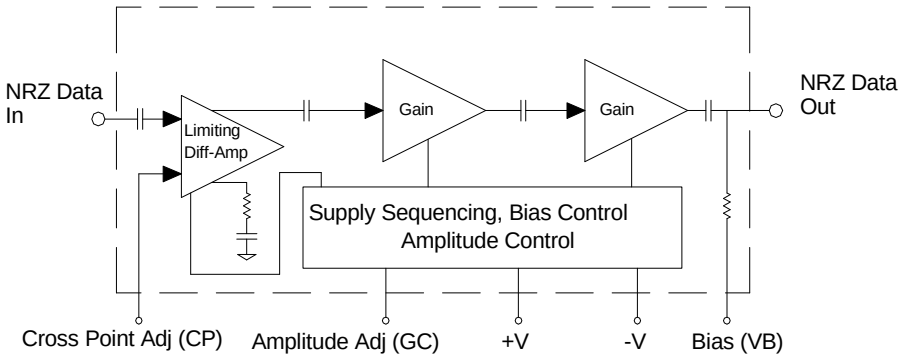
The differential limiting amplifier at the front end provides the user with a means to adjust the cross point of the output eye waveform. It also provides the subsequent gain stages with a constant amplitude signal, making the amplified output signal less sensitive to variations at the iT5082 input. Fabricated using GaAs pHEMT devices and thin-film passive components, the iT5082 exhibits excellent performance and reliability. The iT5082 is available in an SMA connectorized module. The primary heat conduction path is through the base of the module, so proper thermal management is required. Operating case temperature range is 0°C to 70°C.

Features

- Optimized for NRZ bit rates up to 12.5 Gb/s
- Non-inverting polarity
- Input sensitivity: 100 mV
- Adjustable output amplitude from 1.5 V to 7.0 V
- Amplitude modulation of output signal
- Adjustable eye crossing from 30% to 70%
- Low RMS jitter degradation
- 2.7 W typical power dissipation at 7.0 V output
- AC-coupled RF inputs and outputs



Functional Block Diagram



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Absolute Maximum Ratings[1]

Symbol	Parameter	Min	Typ	Max	Units
+V	Positive supply voltage	0		10.0	V
-V	Negative supply voltage	-6.0		0	V
VDIN	Input data amplitude			1.0	Vpp
VGC	Amplitude control voltage	0		6	V
VCP	Cross point control voltage	-6		6	V
VB	Output DC bias	-20		+20	V
TCASE	Case operating temperature	0		75	^{O}C
TSTO	Storage temperature	-65		125	^{O}C

1. Exceeding the maximum ratings may cause damage to this product or lead to reduced reliability. Functional performance is specified over the recommended operating conditions for power supply and temperature. AC and DC device characteristics at or beyond the absolute maximum ratings are not assured or implied.

Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units
+V	Positive supply voltage	7.75	8.0	8.25	V
I_{CC}	Positive supply current[1]	120		320	mA
-V	Negative supply voltage	-5.25	-5.0	-4.75	V
I_{EE}	Negative supply current	100	110	120	mA
T_{CASE}	Case operating temperature[2]	0		70	^{O}C

1. Icc is a function of the output amplitude setting. Current increases as output amplitude is increased. See charts for typical performance data.

2. The iT5082 is a heat-down device. This means that the primary heat conduction path for the package is through its base. Thermal considerations when selecting a heat sink include device orientation, air flow, air temperature, and other physical and mechanical constraints determined by the final application.

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Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Condition	Unit
	Polarity				Non Inverting	
F_B	Bit rate	9.9		12.5	NRZ	Gb/s
F_{LOW}	Low frequency 3 dB bandwidth			50		kHz
S_{11}	Input match 100 kHz – 10 GHz		-10		50 Ω system	dB
S_{22}	Output match 100 kHz – 10 GHz		-10		50 Ω system	dB
V_{DIN}	Data input amplitude range	100		800	50 Ω source	mVp-p
V_{DOUT}	Guaranteed output amplitude range	1.5		7.0	Amplitude adjusted using GC pin Note 3.	Vp-p
V_{GC}	Amplitude control voltage	0		+5.0	Note 4.	V
Z_{GC}	Amplitude control input impedance	500				Ω
FMOD	Amplitude modulation bandwidth	1		10	2% modulation Note 5.	kHz
CP	Guaranteed cross point range	30		70	Note 6	%
VCP	Cross point control voltage	-5.0		+5.0	Note 7	V
ZCP	Cross point control input impedance	1k				Ω
JDEG	RMS jitter degradation $J_{DEG} = \sqrt{[\text{Output RMS Jitter}]^2 - [\text{Input RMS Jitter}]^2}$		1.5	2.5	Eye cross point 50% Note 8.	ps
RBIAS	Bias port resistance		1k			Ω

Notes:

3. Operation is not specified or recommended outside the guaranteed output amplitude range.

4. The VGC voltage necessary to achieve output amplitude within the guaranteed range will be between 0 V and +5.0 V. Operation is not specified or recommended at VGC voltages other than those necessary to achieve output amplitude within the guaranteed range. The iT5082 output will be disabled if the GC pin is left open.

5. The “Typical Modulation Characteristics” plot provides the required dither amplitude that must be applied to the GC pin to achieve 2% amplitude modulation. The plot provides this information for dither frequencies between 1 kHz and 10 kHz and for various output amplitude settings.

6. Operation is not specified or recommended outside the guaranteed cross point range.

7. The VCP voltage necessary to achieve a cross point within the guaranteed range will be between -5.0 V and 5.0 V. Operation is not specified or recommended at VCP voltages other than those necessary to achieve a cross point within the guaranteed range. See the plot “Typical Cross Point Control Characteristics”.

8. Jitter degradation will increase as cross point is adjusted further from its nominal 50% level.

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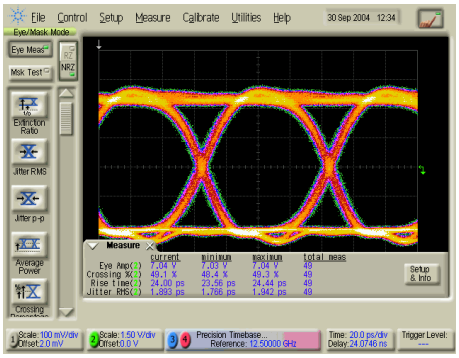
Typical Measured Performance

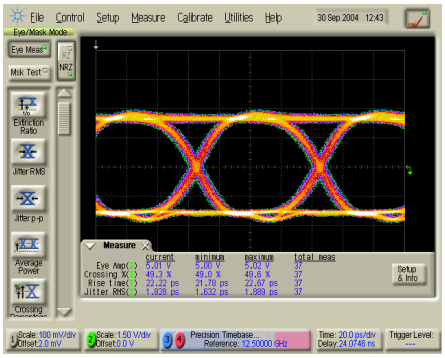
Test conditions

+V = 8.0 V
-V = -5.0 V
TCASE ≈ 30°C
FB = 12.5 Gb/s.

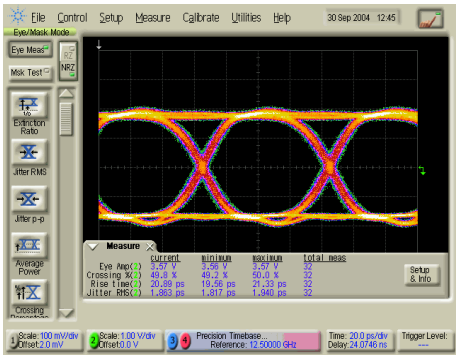
All time-domain data collected using DCA86100A sampling scope with 50 GHz electrical module and precision time base module.



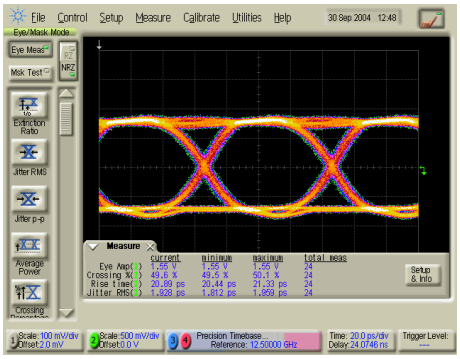
Input amplitude = 400 mV,
Output amplitude ≈ 7.0 V



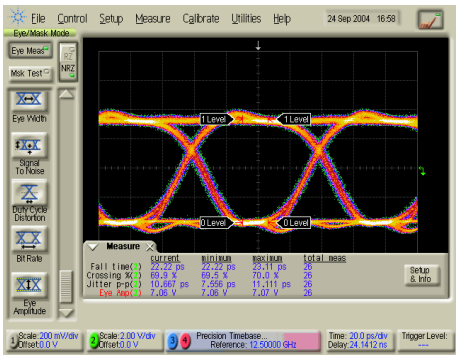
Input amplitude = 400 mV
Output amplitude ≈ 5.0 V



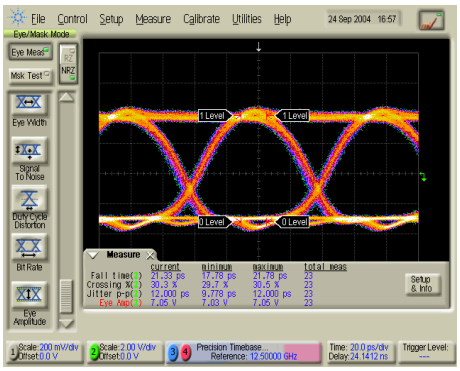
Input amplitude = 400 mV
Output amplitude ≈ 3.5V



Input amplitude = 400 mV
Output amplitude ≈ 1.5 V



Output amplitude ≈ 7.0 V
Eye cross point ≈ 70%



Output amplitude ≈ 7.0 V
Eye cross point ≈ 30%

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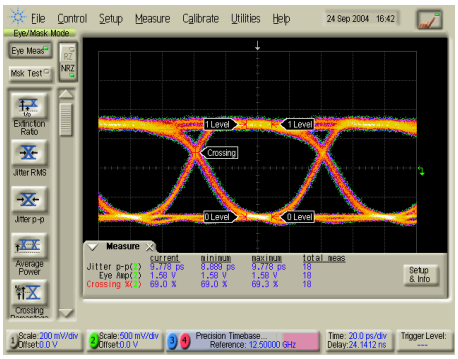
Typical Measured Performance (cont.)

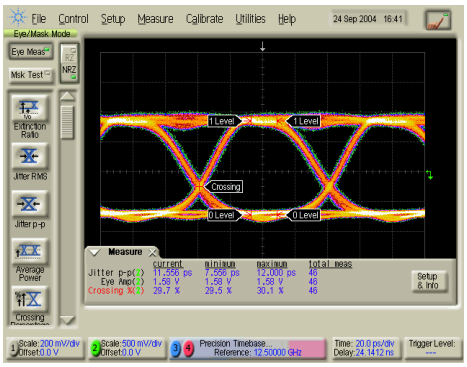
Test conditions

+V = 8.0 V
-V = -5.0 V
TCASE ≈ 30°C
FB = 12.5 Gb/s.

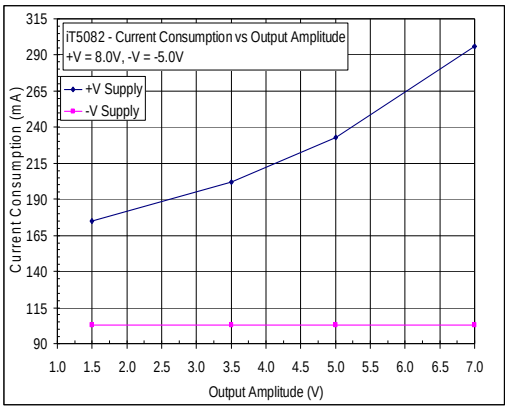
All time-domain data collected using DCA86100A sampling scope with 50 GHz electrical module and precision time base module.

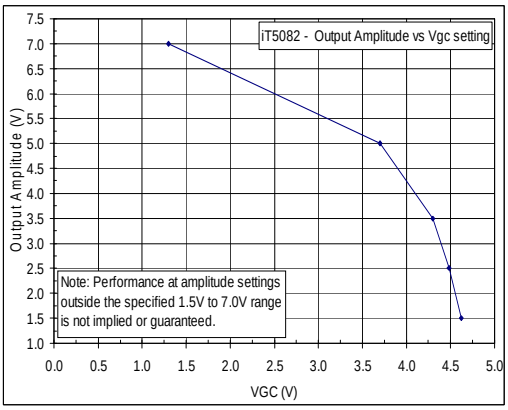


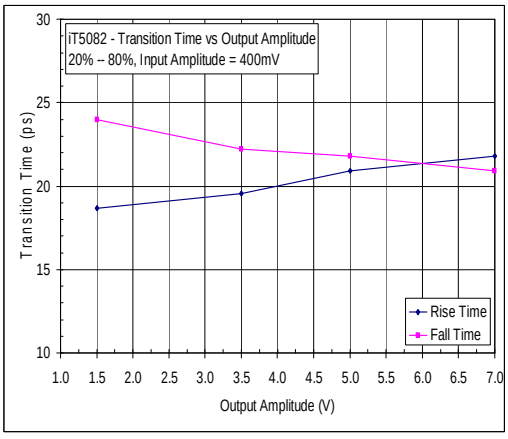
Output amplitude ≈ 1.5 V
Eye cross point ≈ 70%

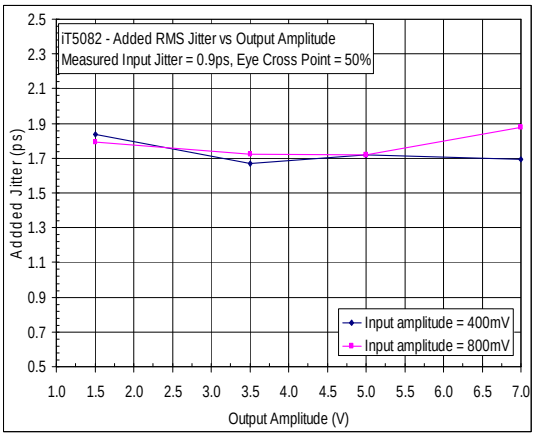


Output amplitude ≈ 1.5 V
Eye cross point ≈ 30%









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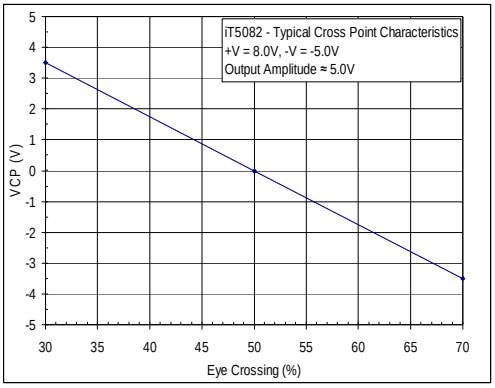
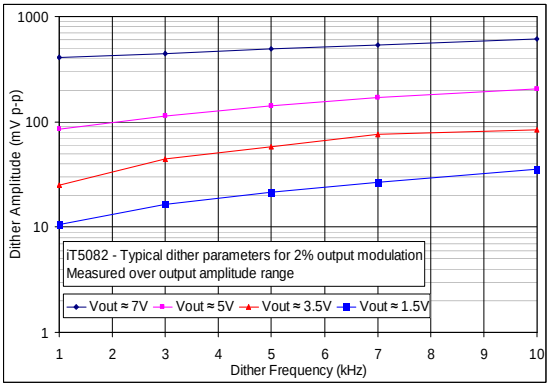
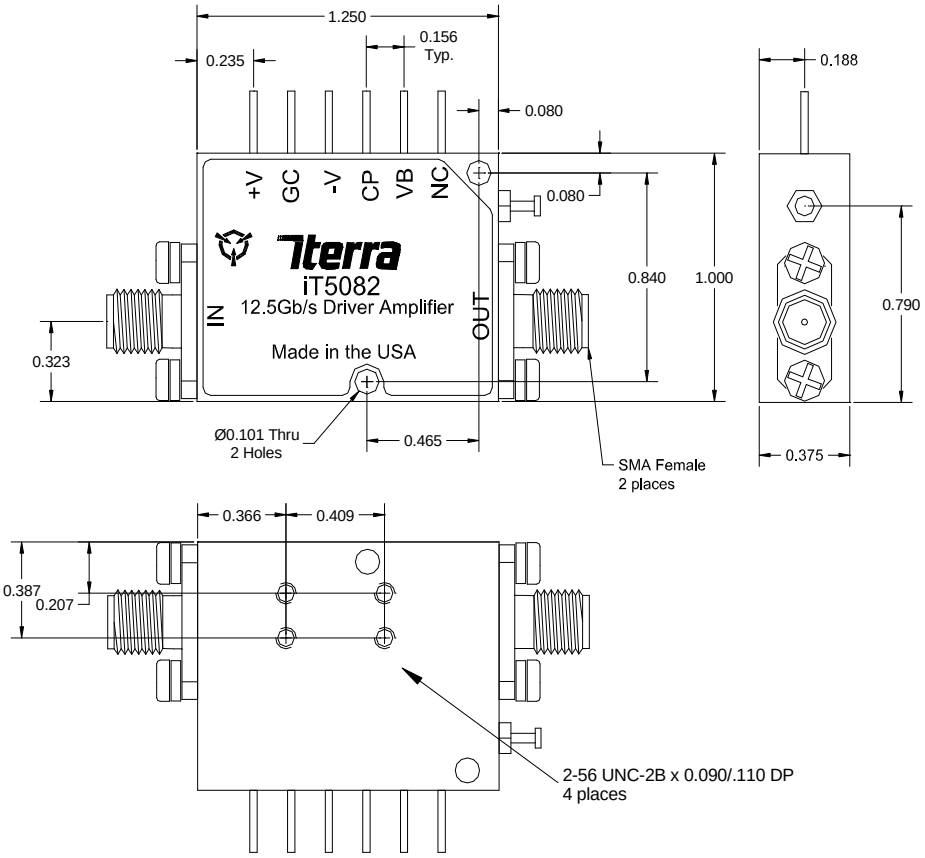
Typical Measured Performance (cont.)





Mechanical Information



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Module I/O

Port	Description
IN	SMA female connector. This port is internally AC coupled and matched to 50 Ω. Apply input data in NRZ format between 9.9 and 12.5 Gb/s. Acceptable data amplitude range is 100 mV – 800 mV.
+V	Positive DC power supply input. Current consumption will depend on the output amplitude setting. Typical current consumption with output amplitude set for 7.0 V is 300 mA.
GC	Output amplitude control voltage input. Control voltages between 0 V and +5.0 V will produce a corresponding output amplitude between 7.0 V and 1.5 V. The iT5082 output will be disabled if the GC pin is left open. See "Typical Current Consumption" plot for typical characteristics.
-V	Negative DC power supply input. Typical current consumption at -5.0 V is 110 mA.
CP	Cross point control voltage input. Control voltages between +5.0 V and -5.0V will produce a corresponding output eye cross point between 30% and 70%. See "Typical Cross Point Control Characteristics" plot for typical characteristics.
VB	Bias input port. A 1 kΩ resistor is internally connected between the VB pin and the OUT port. This allows the user to apply a DC level to the modulator input via the iT5082.
NC	No internal connection.
OUT	SMA female connector. This port is internally AC coupled and matched to 50 Ω. The output signal amplitude can be set between 1.5 V and 7.0 V using the GC control input.

Typical Evaluation Setup Instructions

The connection diagram shown in the diagram on Page 8 is typical for evaluating the time-domain performance of the iT5082. For successful evaluation, note the following items:

- Always observe proper ESD practices while handling and testing the iT5082 module.
- Always use a heat sink while operating the iT5082.
- Use SMA cable assemblies to connect test equipment to the iT5082. For the NRZ Data Out port, use a short cable assembly because cable slope over frequency will degrade measurement results. Do not over-tighten SMA connections.
- A 30 dB SMA attenuator is typically installed at the data output port for module characterization. This will ensure that the sampling scope input is not overdriven when the iT5082 is set for high output amplitude. For best results, the attenuator is connected directly to the iT5082 module followed by a short SMA cable assembly or a direct connection to the scope input.

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Typical Evaluation Setup Instructions (cont.)

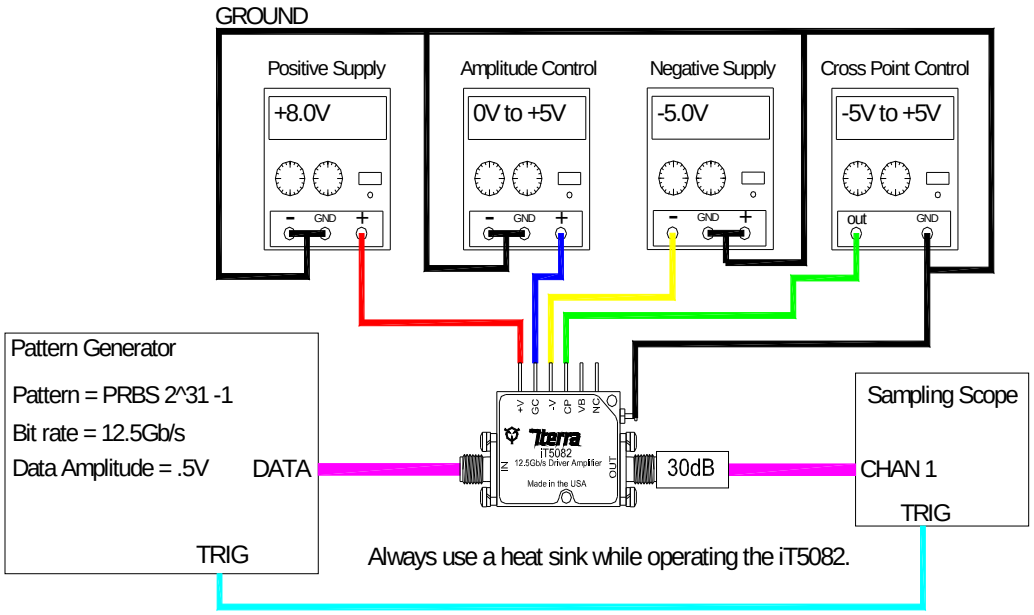
Power-up Steps

- Make sure all supplies are properly grounded. Connect the ground lead to the appropriate module pin.
- Set pattern generator data output amplitude to 500 mV and connect to the data input connector.
- Ramp the negative supply until -5.0 V is measured at the module –V pin (see supply sequencing note below).
- Ramp the positive supply until +8.0 V is measured at the module +V pin (see supply sequencing note below).
- Apply the amplitude adjustment voltage (VGC) to achieve the desired output amplitude. Higher VGC voltages correspond to lower output amplitudes. The iT5082 output will be disabled if the GC pin is left open.
- Apply the cross point adjustment voltage (VCP) to achieve the desired eye cross point level. VCP < 0 V corresponds to cross point levels <50%. VCP >0 V corresponds to cross point levels >50%.

Supply Sequencing

The iT5082 includes an internal protection circuit that eliminates the need for a specific turn-on or turn-off sequence. Either positive (+V) or negative voltage (-V) can be connected or disconnected without causing damage to the device. However, neither VCP nor VGC should be applied to the iT5082 if the module is not powered.

Evaluation Setup



This is a Production data sheet. See "Product Status Definitions" on Web site or catalog for product development status.

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