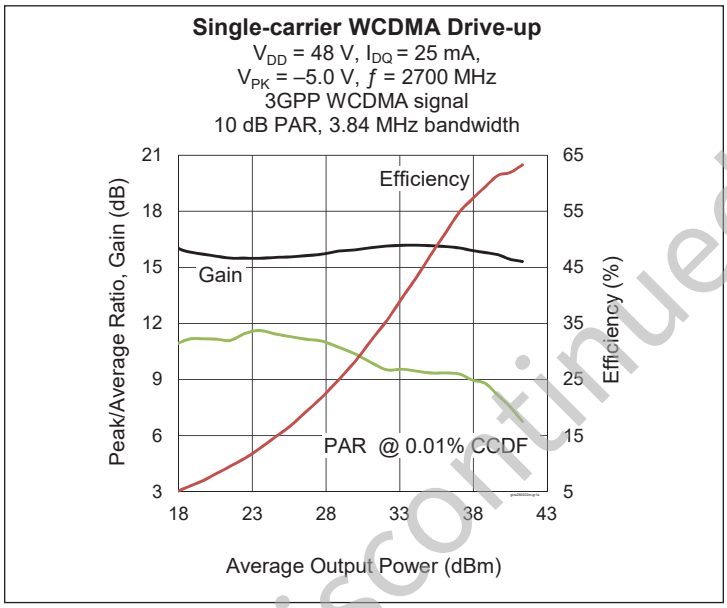
GTRA260502M

Thermally-Enhanced High Power RF GaN on SiC HEMT
50 W, 48 V, 2515 – 2675 MHz

Description

The GTRA260502M is a 50-watt (P3dB) GaN on SiC high electron mobility transistor (HEMT) for use in multi-standard cellular power amplifier applications. It features input matching, high efficiency, and a thermally-enhanced DFN SMD package.

GTRA260502M
Package PG-DFN-6.5x7-1



Features

- GaN on SiC HEMT technology
- Typical pulsed CW performance: 10 µs pulse width, 10% duty cycle, 2690 MHz, 48 V, Doherty configuration
  - Efficiency = 64%
  - Output power at P_{3dB} = 50 W
- Human Body Model Class 1A (per ANSI/ESDA/JEDEC JS-001)
- Low thermal resistance
- Pb-free and RoHS compliant

Typical RF Characteristics

Single–carrier WCDMA Specifications (tested in Wolfspeed application circuit for 2515 –2675 MHz)
V_{DD} = 48 V, I_{DQ} = **25** mA, $V_{GS(peak)}$ = – **5** V, channel bandwidth = 3.84 MHz, input PAR = 10 dB @ 0.01% CCDF

	P_{OUT} (dBM)	Gain (dB)	Efficiency (%)	ACPR + (dBc)	ACPR – (dBc)	OPAR (dB)
2500 MHz	39.0	15.8	59.5	–28.5	–28.5	8.6
2550 MHz	39.0	16.2	59.7	–28.2	–28.2	8.4
2600 MHz	39.0	16.5	59.2	–27.2	–27.2	8.2
2650 MHz	39.0	16.6	56.3	–26.5	–26.4	7.9
2700 MHz	39.0	16.4	53.9	–26.3	–26.1	8.1

All published data at T_{CASE} = 25°C unless otherwise indicated

ESD: Electrostatic discharge sensitive device—observe handling precautions!

RoHS COMPLIANT

DC Characteristics

Characteristic		Conditions	Symbol	Min	Typ	Max	Unit
Drain-source Breakdown Voltage	(main)	V_{GS} = –8 V, I_D = 10 mA	$V_{(BR)DSS}$	150	—	—	V
	(peak)	V_{GS} = –8 V, I_D = 10 mA	$V_{(BR)DSS}$	150	—	—	V
Drain-source Leakage Current		V_{GS} = –8 V, V_{DS} = 10 V	I_{DSS}	—	—	5	mA
Gate Threshold Voltage	(main)	V_{DS} = 10 V, I_D = 2.6 mA	$V_{GS(th)}$	–3.8	–3	–2.3	V
	(peak)	V_{DS} = 10 V, I_D = 4.3 mA	$V_{GS(th)}$	–3.8	–3	–2.3	V

Recommended Operating Conditions

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Operating Voltage		V_{DD}	0	—	50	V
Gate Quiescent Voltage	V_{DS} = 48 V, I_D = 25 mA	$V_{GS(Q)}$	–4	–3	–1.9	V

Absolute Maximum Ratings

Parameter		Symbol	Value	Unit
Drain-source Voltage		V_{DSS}	125	V
Gate-source Voltage		V_{GS}	–10 to +2	V
Operating Voltage		V_{DD}	55	V
Gate Current	(main)	I_G	2.6	mA
	(peak)	I_G	4.3	mA
Drain Current	(main)	I_D	1.0	A
	(peak)	I_D	1.6	A
Junction Temperature		T_J	225	°C
Storage Temperature Range		T_{STG}	–65 to +150	°C

Operation above the maximum values listed here may cause permanent damage. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the component. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. For reliable continuous operation, the device should be operated within the operating voltage range (V_{DD}) specified above.

Thermal Characteristics

Thermal resistance, junction to case (T_{CASE} = 70°C)
V_{DD} = 48 V, I_{DQ} = 25 mA, $V_{GS(pk)}$ = –5 V, f = 2595 MHz

Parameter		Symbol	Value	Unit
Thermal Resistance	(main) P_{DISS} = 12.5 W_{AVG} DC	$R_{\theta JC}$	7.3	°C/W
	(peak) P_{DISS} = 20.4 W_{AVG} DC	$R_{\theta JC}$	6.5	°C/W

Moisture Sensitivity Level

Level	Test Signal	Package Temperature	Unit
3	IPC/JEDEC J-STD-020	260	°C

RF Characteristics

Single-carrier WCDMA Specifications (tested in Wolfspeed Doherty production test fixture)

V_{DD} = 48 V, I_{DQ} = 25 mA, P_{OUT} = 7.94 W, $V_{GS(peak)}$ = –4.5 V, f = 2675 MHz,
3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

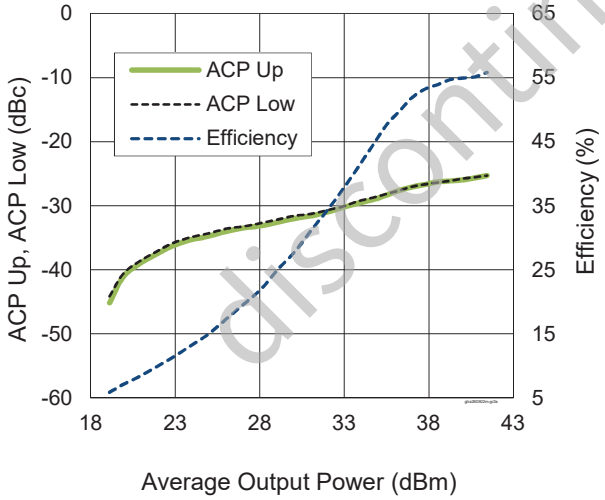
Characteristics	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	12.5	14	—	dB
Drain Efficiency	η_D	40	47.5	—	%
Adjacent Channel Power Ratio	ACPR	—	–25	–20	dBc
Output PAR @ 0.01% CCDF	OPAR	7.1	7.6	—	dB

Ordering Information

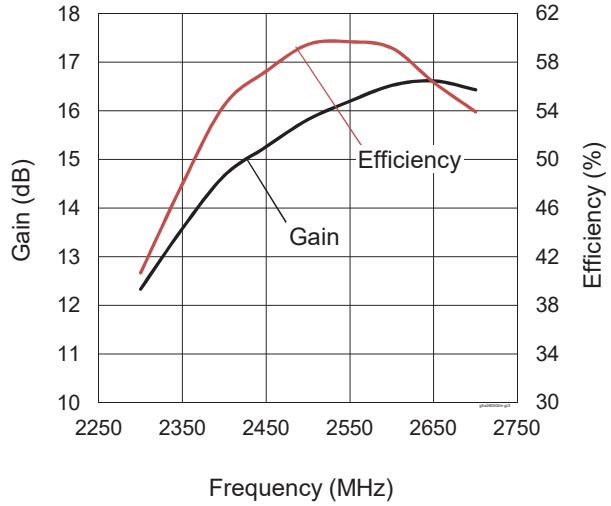
Type and Version	Order Code	Package	Shipping
GTRA260502M V1 R3K	GTRA260502M-V1-R3K	PG-DFN-6.5x7-1	Tape & Reel, 3000 pcs

Typical Performance (data taken in a Wolfspeed production test fixture)

Single-carrier WCDMA Drive-up
V_{DD} = 48 V, I_{DQ} = 25 mA,
V_{PK} = –5.0 V, f = 2700 MHz
3GPP WCDM signal
10 dB PAR, 3.84 MHz bandwidth

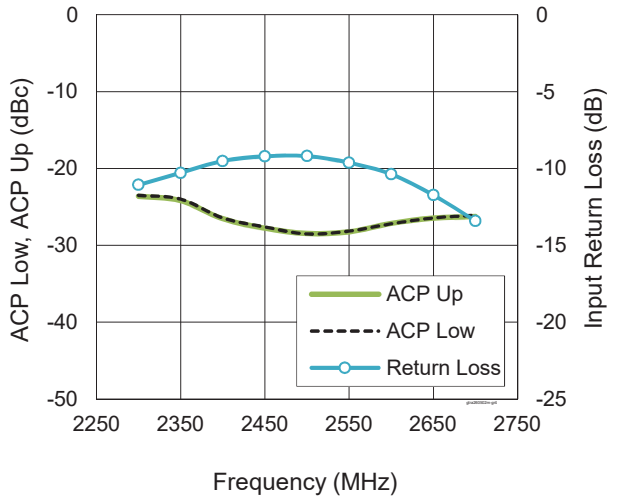


Single-carrier WCDMA, Broadband
V_{DD} = 48 V, I_{DQ} = 25 mA,
V_{PK} = –5.0 V, P_{OUT} = 39 dBm
3GPP WCDMA signal
10 dB PAR, 3.84 MHz bandwidth

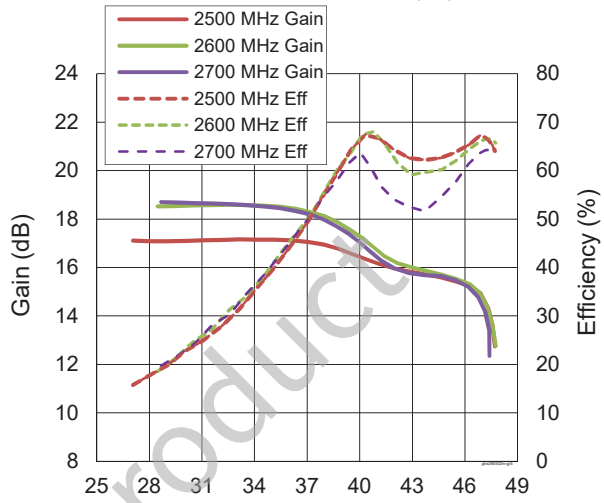


Typical Performance (cont.)

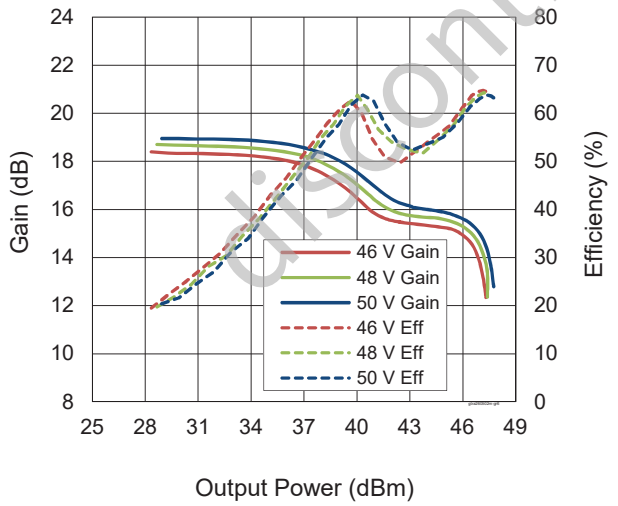
Single-carrier WCDMA Broadband
V_{DD} = 48 V, I_{DQ} = 25 mA,
V_{PK} = –5.0 V, P_{OUT} = 39 dBm
3GPP WCDMA signal
10 dB PAR, 3.84 MHz bandwidth



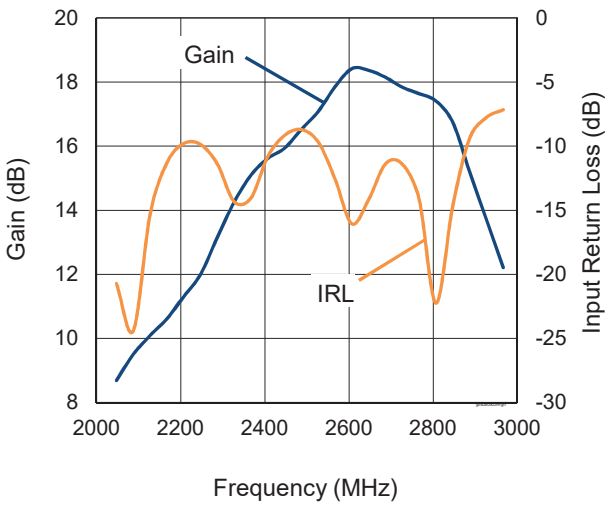
Pulsed CW Performance
V_{DD} = 48 V, I_{DQ} = 25 mA, V_{PK} = –5.0 V
20 µs pulse width, 10% duty cycle



Pulsed CW Performance at various V_{DD}
I_{DQ} = 25 mA, V_{PK} = –5.0 V
20 µs pulse width, 10% duty cycle,
f = 2700 MHz



Small Signal CW Performance
Gain and Input Return Loss
V_{DD} = 48 V,
I_{DQ} = 25 mA, V_{PK} = –5.0 V



Load Pull

Main Side Load Pull Performance – Pulsed CW signal – 10 µsec pulse width, 10% duty cycle, 48 V, 26 mA I_{DQ}, class AB

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
2515	20 – j36	24.9 + j0.28	17.6	43.58	23	58.9	17.3 + j22.7	19.9	41.61	15	76.9
2675	37 – j25	22.6 + j6.9	17.4	43.56	23	65.3	12.2 + j24.0	19.0	40.66	12	77.3

Peak Side Load Pull Performance – Pulsed CW signal – 10 µsec pulse width, 10% duty cycle, 48 V, 45 mA I_{DQ}, class AB

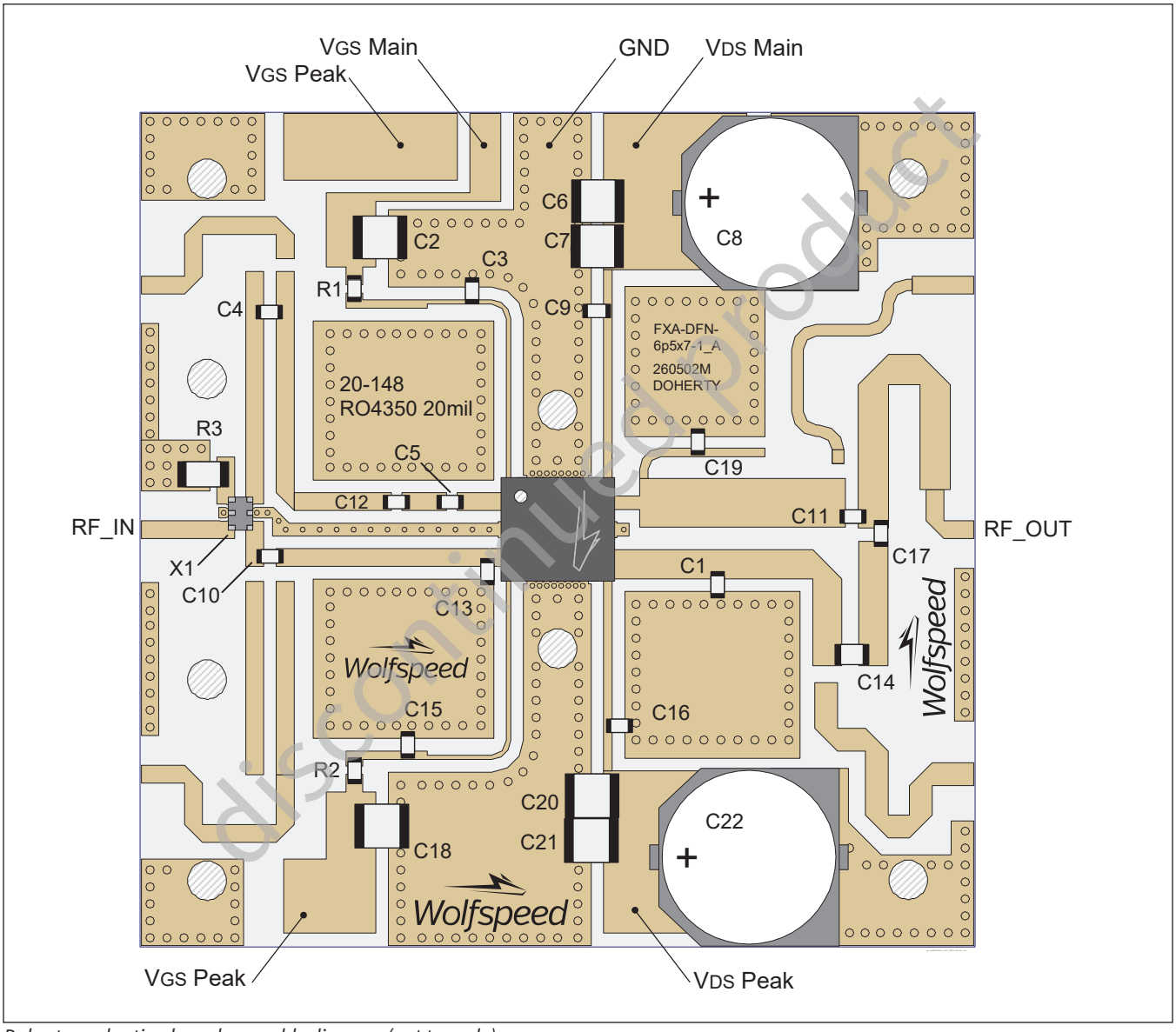
		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
2515	9.2 – j21.0	12.5 + j3.3	18	46.38	44	62.8	8.3 + j13.2	20.3	44.13	26	75.1
2675	23.5 – j22.5	12.5 + j3.5	17.6	46.22	42	64.8	7.7 + j10.7	20.0	44.46	28	75.5

See next page for Doherty Evaluation Board

Doherty Evaluation Board, 2515 – 2675 MHz

Evaluation Board Assembly

DUT	GTRA260502M
Test Fixture Part No.	LTA/GTRA260502M E11
PCB	Rogers 4350, 0.508 mm [0.020"] thick, 2 oz. copper, ε_r = 3.66
Find Gerber files for this test fixture on the Wolfspeed Web site at **www.wolfspeed.com/RF**	



Doherty evaluation board assembly diagram (not to scale)

Evaluation Board (cont.)

Components Table

Component	Description	Manufacturer	P/N
C1, C5	Capacitor, 1.2 pF, 0805	ATC	ATC600F1R2JT250XT
C2, C6, C7, C18, C20, C21	Capacitor, 10 µF, 100v, 1210	Murata	GRM32EC72A106KE05L
C3	Capacitor, 12pF, 0805	ATC	ATC600F120JT250XT
C4, C12	Capacitor, 15 pf, 0805	ATC	ATC600F150JT250XT
C8, C22	Capacitor, 47 µF, 80 V, FK	Panasonic	EEE-FK1K470P
C9, C10, C11, C14, C15, C16, C17, C19	Capacitor, 18 pf, 0805	ATC	ATC600F180JT250XT
C13	Capacitor, 2.2 pF, 0805	ATC	ATC600F2R2JT250XT
R1, R2	Resistor, 5.1 ohm, 0603		
R3	Resistor, 50 ohm, 8 W, 1206	Anaren	C8A50Z4A
X1	RF Directional Coupler, 3 dB, 2.3-2.7 GHz, 0805	Anaren	C2327J5003AHF

Bias Sequencing

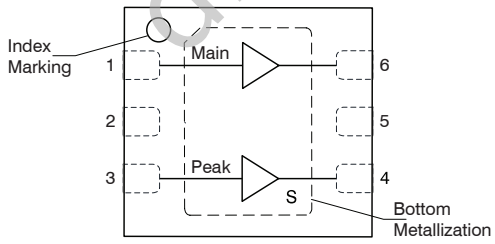
Bias ON

1. Ensure RF is turned off
2. Apply pinch-off voltage of –5 V to the gate
3. Apply nominal drain voltage
4. Bias gate to desired quiescent drain current
5. Apply RF

Bias OFF

1. Turn RF off
2. Appliy pinch-off voltage to the gate
3. Turn off drain voltage
4. Turn off gate voltage

Pinout Diagram (Package PG-DFN-6.5x7-1, top view)



Pin	Description
1	RF_{IN} (main)
2	N/C*
3	RF_{IN} (peak)
4	RF_{OUT} (peak)
5	N/C*
6	RF_{OUT} (main)
S	Ground (package, bottom metallization)

** It is recommended that all pins labelled "N/C" be connected to ground*

Package Outline Specifications

Package PG-DFN-6.5x7-1

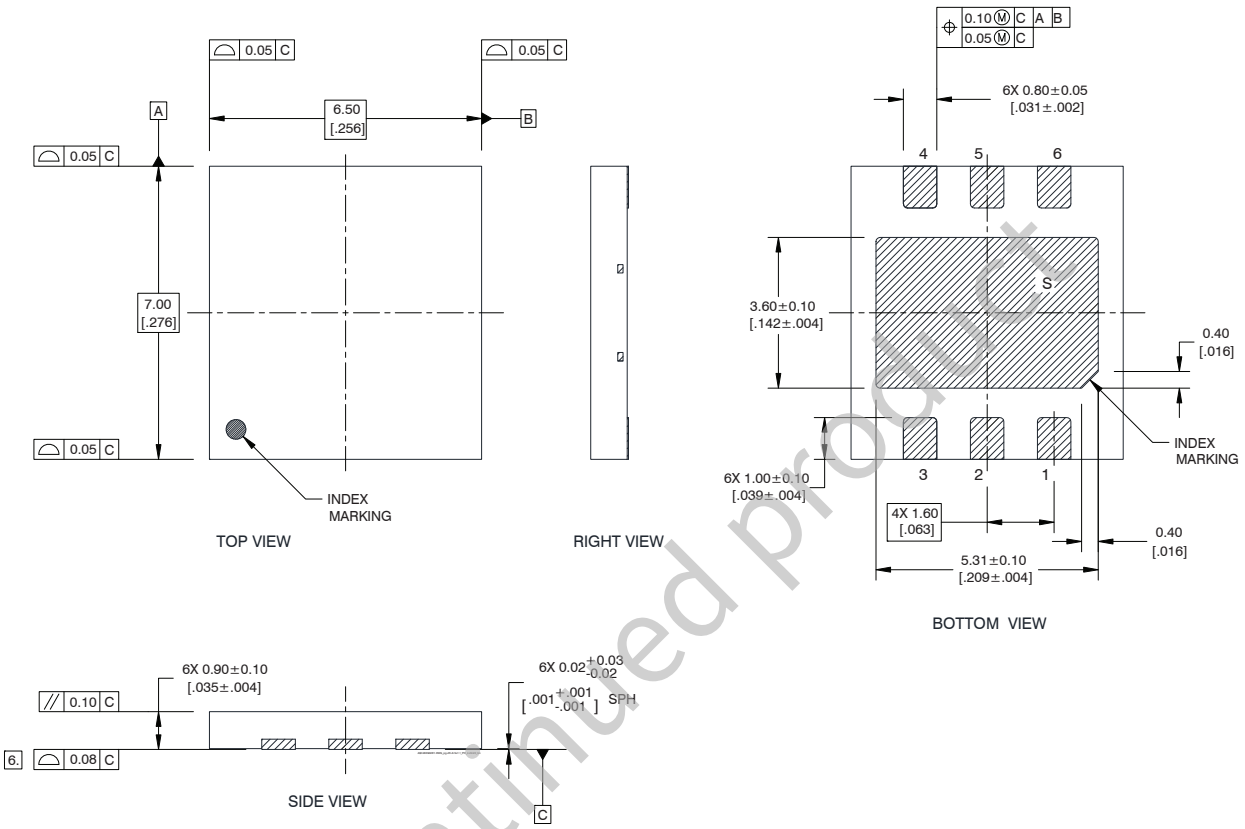


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994
2. Package dimensions: 6.50 mm X 7.00 mm X 0.90 mm
3. Primary dimensions are mm; alternate dimensions are inches
4. Pinout Diagram on previous page
5. Tin plating thickness: 7 to 15 micron [275.6 to 590.6 microinch]
6. Coplanarity applies to all terminals and flange

Revision History

Revision	Date	Type	Page	Subjects (major changes at each revision)
01	2020-07-01	Preliminary	all	Proposed specification for new product development
02	2021-06-09	Production	all	Data Sheet reflects released product specifications

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Notes & Disclaimer

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