

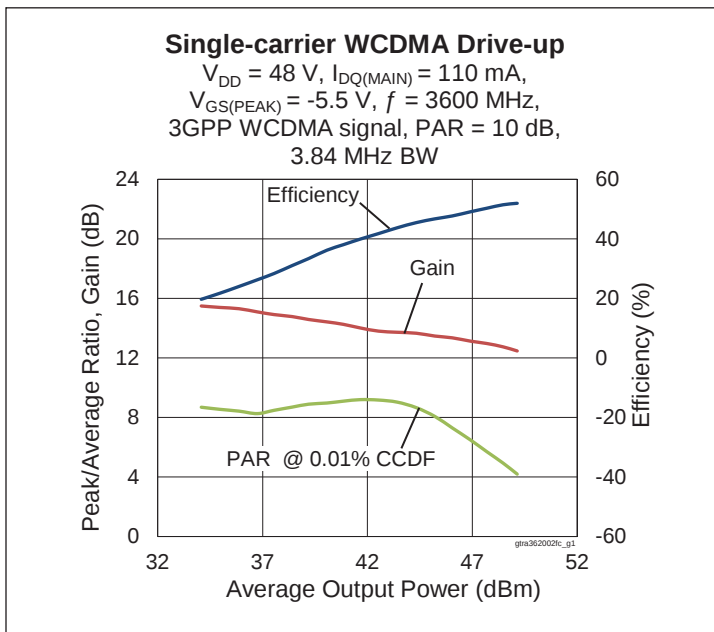
GTRA362002FC

Thermally-Enhanced High Power RF GaN on SiC HEMT 200 W, 48 V, 3400 – 3600 MHz

Description

The GTRA362002FC is a 200-watt (P_{3dB}) GaN on SiC high electron mobility transistor (HEMT) designed for use in multi-standard cellular power amplifier applications. It features input matching, high efficiency, and a thermally-enhanced package with earless flange.

GTRA362002FC
Package H-37248C-4



Features

- GaN on SiC HEMT technology
- Input matched
- Asymmetrical Doherty design
 - Main: $P_{3dB} = 85\text{ W Typ}$
 - Peak: $P_{3dB} = 115\text{ W Typ}$
- Typical Pulsed CW performance, 3500 MHz, 48 V, combined outputs
 - Output power at $P_{3dB} = 200\text{ W}$
 - Efficiency = 60%
 - Gain = 12.5 dB
- Capable of handling 10:1 VSWR @50 V, 30 W (WCDMA) output power
- Human Body Model Class 1A, (per ANSI/ESDA/JEDEC JS-001)
- Low thermal resistance
- Pb-free and RoHS compliant

RF Characteristics

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

$V_{DD} = 48\text{ V}$, $I_{DQ} = 110\text{ mA}$, $P_{OUT} = 29\text{ W avg}$, $V_{GS(peak)} = V_{GS @ I_{DQ}} = 140\text{ mA} - 2.0\text{ V}$, $f = 3600\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	12.5	13.5	—	dB
Drain Efficiency	η_D	38	42	—	%
Adjacent Channel Power Ratio	ACPR	—	-29	-26	dBc
Output PAR @ 0.01% CCDF	OPAR	7	7.7	—	dB

All published data at $T_{CASE} = 25^\circ\text{C}$ unless otherwise indicated

ESD: Electrostatic discharge sensitive device—observe handling precautions!

DC Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-source Breakdown Voltage	$V_{GS} = -8\text{ V}$, $I_D = 10\text{ mA}$	$V_{(BR)DSS}$	150	—	—	V
Drain-source Leakage Current	$V_{GS} = -8\text{ V}$, $V_{DS} = 10\text{ V}$	I_{DSS}	—	—	5	mA
Gate Threshold Voltage (main)	$V_{DS} = 10\text{ V}$, $I_D = 10.8\text{ mA}$	$V_{GS(th)}$	-3.8	-3.0	-2.3	V
(peak)	$V_{DS} = 10\text{ V}$, $I_D = 14.4\text{ mA}$	$V_{GS(th)}$	-3.8	-3.0	-2.3	V

Recommended Operating Conditions

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Operating Voltage		V_{DD}	0	—	50	V
Gate Quiescent Voltage	$V_{DS} = 48\text{ V}$, $I_D = 110\text{ mA}$	$V_{GS(Q)}$	-3.6	-3.0	-2.3	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	10.8	mA
(peak)	I_G	14.4	mA
Drain Current (main)	I_D	4.1	A
(peak)	I_D	5.4	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

Parameter	Symbol	Value	Unit
Thermal Resistance (main, $T_{CASE} = 70\text{ °C}$, 53 W DC)	$R_{\theta JC}$	2.8	°C/W
(peak, $T_{CASE} = 70\text{ °C}$, 73 W DC)	$R_{\theta JC}$	2.1	°C/W

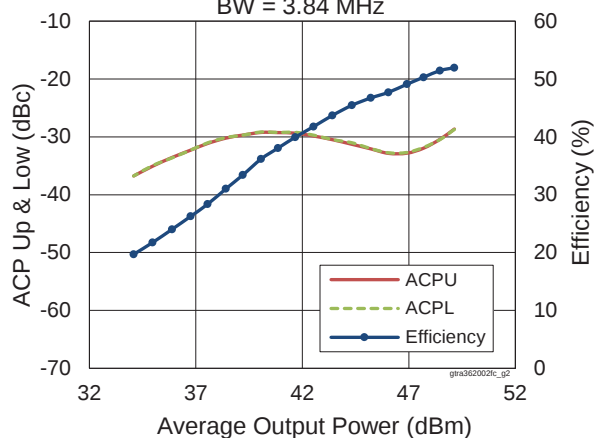
Ordering Information

Type and Version	Order Code	Package	Shipping
GTRA362002FC V1 R0	GTRA362002FC-V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRA362002FC V1 R2	GTRA362002FC-V1-R2	H-37248C-4	Tape & Reel, 250 pcs

Typical Performance (data taken in test fixture)

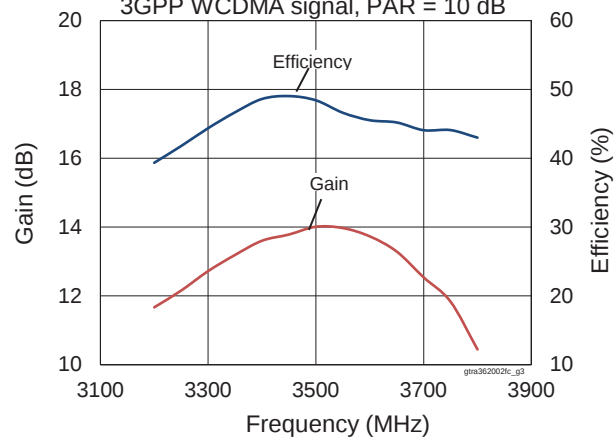
Single-carrier WCDMA Drive-up

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 110\text{ mA}$,
 $V_{GS(PEAK)} = -5.5\text{ V}$, $f = 3600\text{ MHz}$,
 3GPP WCDMA signal, PAR = 10 dB,
 BW = 3.84 MHz



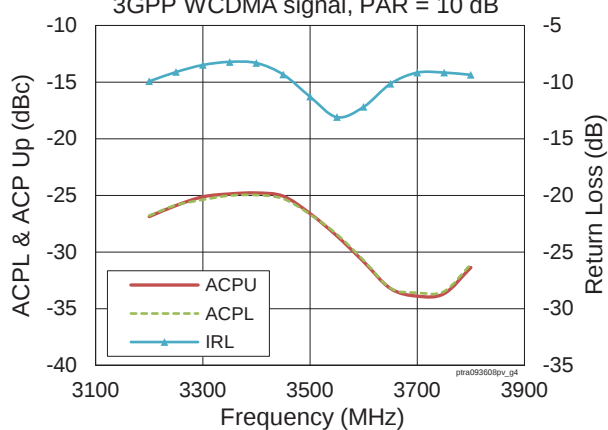
Single-carrier WCDMA Broadband Performance

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 110\text{ mA}$,
 $V_{GS(PEAK)} = -5.5\text{ V}$, $P_{OUT} = 44.6\text{ dBm}$,
 3GPP WCDMA signal, PAR = 10 dB



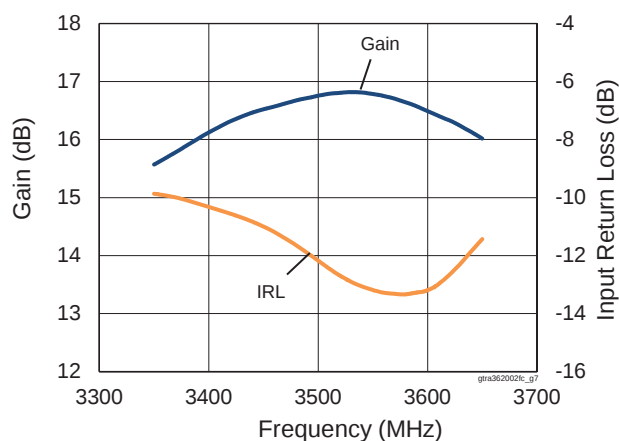
Single-carrier WCDMA Broadband Performance

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 110\text{ mA}$,
 $V_{GS(PEAK)} = -5.5\text{ V}$, $P_{OUT} = 44.6\text{ dBm}$,
 3GPP WCDMA signal, PAR = 10 dB

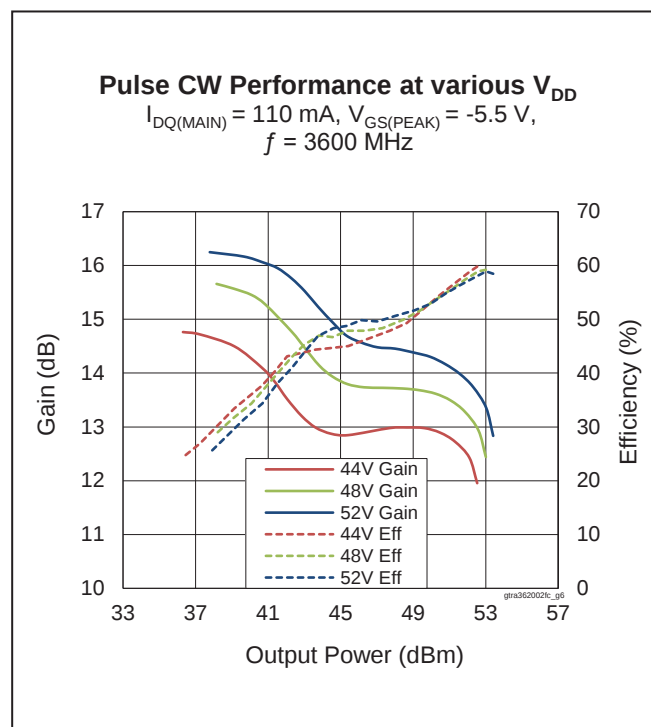
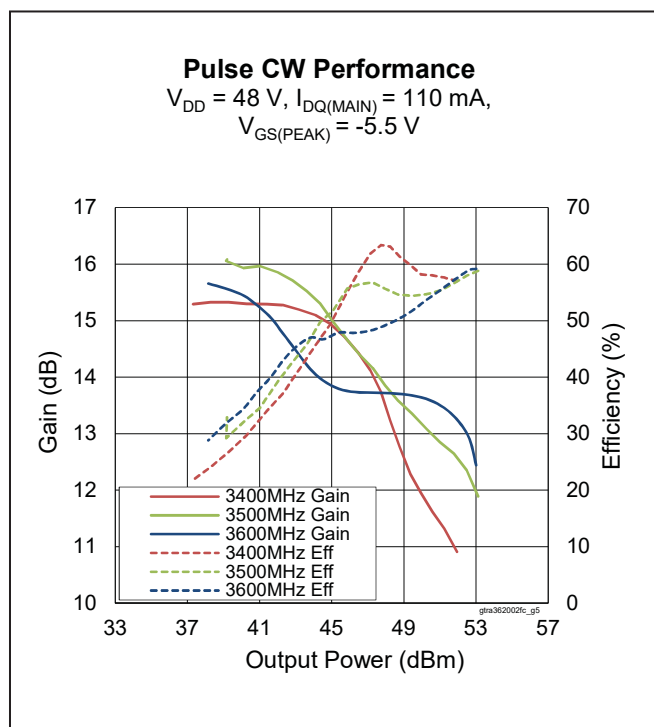


CW Performance Small Signal Gain & Input Return Loss

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 110\text{ mA}$,
 $V_{GSPEAK} = -5.5\text{ V}$



Typical Performance (cont.)



Load Pull

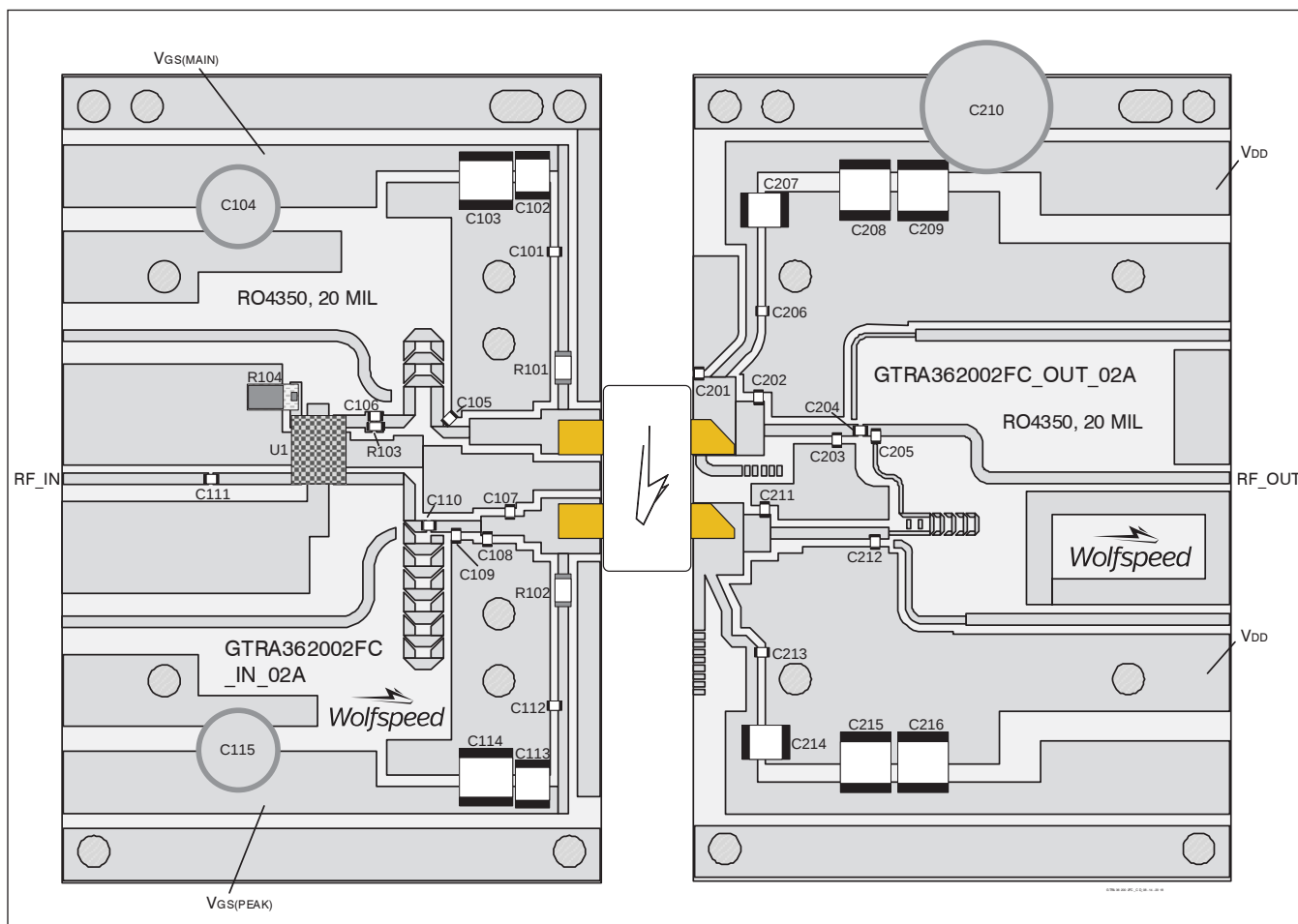
Main Side Load Pull Performance – Pulsed CW signal: 10 μs , 10% duty cycle, 48 V, $I_{DQ} = 110\text{ mA}$, class AB

Freq [MHz]	Z_s [Ω]	P_{3dB}									
		Max Output Power					Max Drain Efficiency				
		Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
3400	21+j11	8.9-j7.7	15.5	51.31	135	70.0	5.2-j6.6	16.7	50.10	102	76.5
3500	14+j4	9.6-j9.2	15.3	51.23	133	68.6	4.9-j6.9	16.6	49.60	91	77.7
3600	11+j0	10.1-j10.4	15.1	51.33	136	68.1	5.5-j8.2	16.4	50.00	100	77.9

Peak Side Load Pull Performance – Pulsed CW signal: 10 μs , 10% duty cycle, 48 V, $I_{DQ} = 140\text{ mA}$, class AB

Freq [MHz]	Z_s [Ω]	P_{3dB}									
		Max Output Power					Max Drain Efficiency				
		Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
3400	30+j8	6.8-j9.8	15.1	52.23	167	61.1	4.4-j7.1	16.8	51.06	127	69.0
3500	21+j3.5	8.0-j10	14.9	52.20	166	61.3	5.4-j6.3	16.2	50.90	123	68.0
3600	17-j0.8	9.1-j9	14.7	52.04	160	60.8	5.3-j7.3	16.2	50.72	118	66.0

Reference Circuit, 3400 – 3600 MHz



Reference circuit assembly diagram (not to scale)

Reference Circuit Assembly

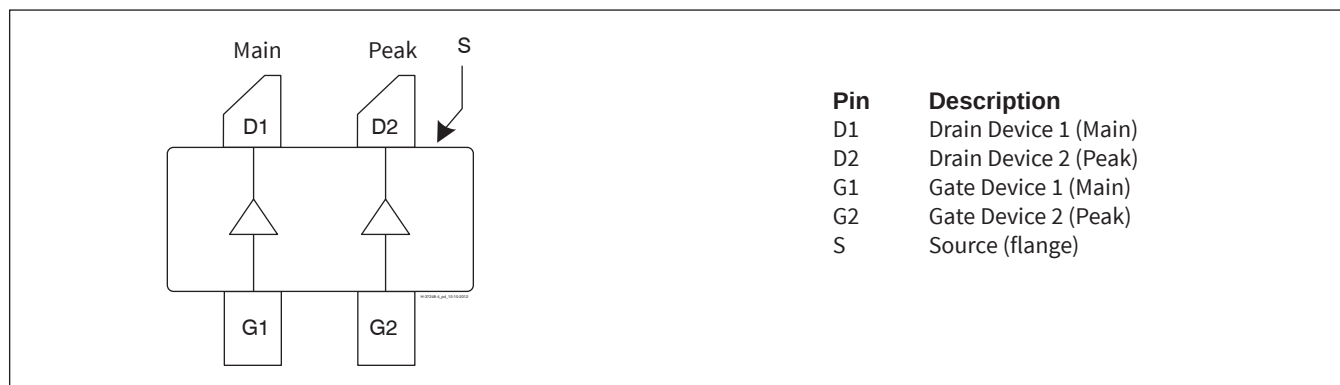
DUT	GTRA362002FC V1
Test Fixture Part No.	LTA/GTRA362002FC V1
PCB	Rogers 4350, 0.508 mm [0.020"] thick, 2 oz. copper, $\epsilon_r = 3.66$
Find Gerber files for this test fixture on the Wolfspeed Web site at www.wolfspeed.com/RF	

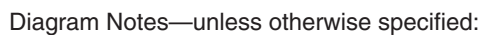
Reference Circuit (cont.)

Components Information

Component	Description	Manufacturer	P/N
Input			
C101, C106, C110, C111, C112	Capacitor, 12 pF	ATC	ATC800A120JT250T
C102, C113	Capacitor, 1 μ F	TDK Corporation	C4532X7R2A105M230KA
C103, C114	Capacitor, 100 V, 10 μ F	TDK Corporation	C5750X7S2A106M230KB
C104, C115	Capacitor, 100 μ F	Panasonic Electronic Components	EEE-FP1H101AP
C105	Capacitor, 0.7 pF	ATC	ATC800A0R7CT250T
C107	Capacitor, 0.5 pF	ATC	ATC800A0R5CT250T
C108	Capacitor, 1.5 pF	ATC	ATC800A1R5CT250T
C109	Capacitor, 0.9 pF	ATC	ATC800A0R9CT250T
R101, R102	Resistor, 5.6 ohms	Panasonic Electronic Components	ERJ-8RQJ5R6V
R103	Resistor, 10 ohms	Panasonic Electronic Components	ERJ-3GEYJ100V
R104	Resistor, 50 ohms	Richardson	C16A50Z4
U1	Hybrid coupler	Anaren	XC3500P-03S
Output			
C201, C202	Capacitor, 0.7 pF	ATC	ATC800A0R7CT250T
C203, C211, C212	Capacitor, 0.3 pF	ATC	ATC800A0R3CT250T
C204, C205, C206, C213	Capacitor, 12 pF	ATC	ATC800A120JT250T
C207, C214	Capacitor, 1 μ F	TDK Corporation	C4532X7R2A105M230KA
C208, C209, C215, C216	Capacitor, 100 V, 10 μ F	TDK Corporation	C5750X7S2A106M230KB
C210	Capacitor, 220 μ F	Panasonic Electronic Components	ECA-2AHG221

Pinout Diagram (top view)





1. Interpret dimensions and tolerances per ASME Y14.5M-1994
2. Primary dimensions are mm, alternate dimensions are inches
3. All tolerances ± 0.127 [0.005]
4. Pins: D1, D2 – drain, G1, G2 – gate, S – source (flange)
5. Lead thickness: 0.13 ± 0.05 [0.005 ± 0.002]
6. Gold plating thickness: 1.14 ± 0.38 micron [45 ± 15 microinch]

Revision History

Revision	Date	Data Sheet Type	Page	Subjects (major changes since last revision)
01	2016-07-14	Advance	All	Data Sheet reflects advance specification for product development
02	2017-07-21	Advance	All	Revised Features and Target RF Characteristics Includes Package
03	2018-04-03	Preliminary	All	Data Sheet reflects preliminary specification
04	2018-08-15	Production	All	Data Sheet reflects released product specification
04.1	2019-01-30	Production	1	Added ESD rating
04.2	2019-07-02	Production	2	Added operating voltage maximum and thermal characteristics for peak side
05	2020-05-11	Production	2	Added gate voltage minimum and maximum

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Notes

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