Thermally-Enhanced High Power RF LDMOS FETs 220 W, 920 – 960 MHz

Description

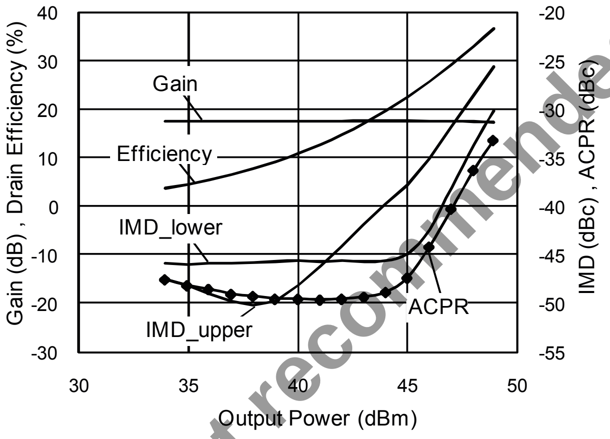
The PTFA092213EL and PTFA092213FL are 220-watt, internally-matched LDMOS FETs designed for use in cellular power amplifier applications in the 920 to 960 MHz band. These devices feature internal I/O matching and thermally-enhanced open-cavity ceramic packages with slotted or earless flanges. Manufactured with Infineon's advanced LDMOS process, these devices provide excellent thermal performance and superior reliability.

PTFA092213EL
Package H-33288-6

PTFA092213FL
Package H-34288-4/2

Two-carrier WCDMA Performance

V_{DD} = 30 V, I_{DQ} = 1850 mA, f = 960 MHz,
3GPP WCDMA signal, PAR = 8 dB,
10 MHz carrier spacing, 3.84 MHz Bandwidth



Features

- Broadband internal matching
- Typical two-carrier WCDMA performance at 960 MHz, 30 V
  - Average output power = 50 W
  - Linear Gain = 17.5 dB
  - Efficiency = 29%
  - Intermodulation distortion = –32 dBc
  - Adjacent channel power = –42.5 dBc
- Typical CW performance, 960 MHz, 30 V
  - Output power at P_{1dB} = 250 W
  - Linear Gain = 17.5 dB
  - Efficiency = 52%
- Integrated ESD protection: Human Body Model, Class 2 (minimum)
- Excellent thermal stability, low HCI drift
- Capable of handling 10:1 VSWR @ 30 V, 220 W (CW) output power
- Pb-free, RoHS-compliant

RF Characteristics

Two-carrier WCDMA Measurements (not subject to production test—verified by design/characterization in Infineon test fixture)
V_{DD} = 30 V, I_{DQ} = 1850 mA, P_{OUT} = 50 W average, f_1 = 950 MHz, f_2 = 960 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 8 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	17.5	—	dB
Drain Efficiency	ηD	—	29	—	%
Intermodulation Distortion	IMD	—	–32	—	dBc

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

ESD: Electrostatic discharge sensitive device—observe handling precautions!

RF Characteristics (cont.)

Two-tone Measurements (tested in Infineon test fixture)
V_{DD} = 30 V, I_{DQ} = 1850 mA, P_{OUT} = 200 W PEP, f = 960 MHz, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	17	17.5	—	dB
Drain Efficiency	ηD	40	42	—	%
Intermodulation Distortion	IMD	—	–30	–28	dBc

DC Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_{DS} = 10 mA	$V_{(BR)DSS}$	65	—	—	V
Drain Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	µA
	V_{DS} = 63 V, V_{GS} = 0 V	I_{DSS}	—	—	10.0	µA
On-State Resistance	V_{GS} = 10 V, V_{DS} = 0.1 V	$R_{DS(on)}$	—	0.04	—	Ω
Operating Gate Voltage	V_{DS} = 30 V, I_{DQ} = 1850 mA	V_{GS}	2.0	2.5	3.0	V
Gate Leakage Current	V_{GS} = 10 V, V_{DS} = 0 V	I_{GSS}	—	—	1.0	µA

Maximum Ratings

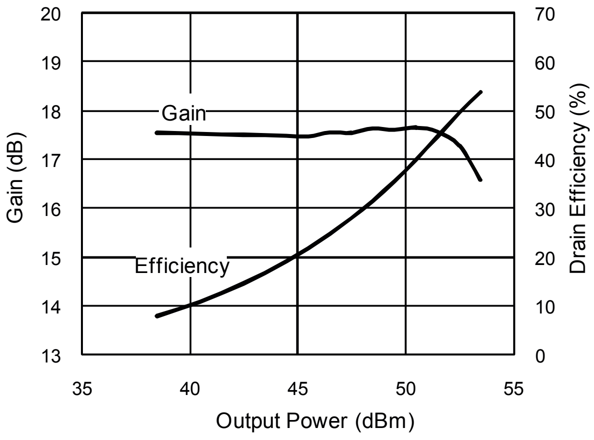
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	V
Gate-Source Voltage	V_{GS}	–0.5 to +12	V
Junction Temperature	T_J	200	°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70 °C, 220 W CW)	$R_{\theta JC}$	0.23	°C/W

Ordering Information

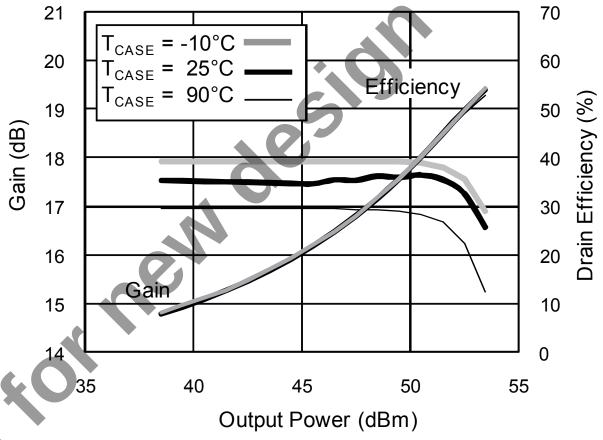
Type and Version	Package Outline	Package Description	Shipping
PTFA092213EL V4	H-33288-6	Thermally-enhanced, slotted flange, single-ended	Tray
PTFA092213EL V4 R250	H-33288-6	Thermally-enhanced, slotted flange, single-ended	Tape & Reel, 250 pcs
PTFA092213FL V5	H-34288-4/2	Thermally-enhanced, earless flange, single-ended	Tray
PTFA092213FL V5 R250	H-34288-4/2	Thermally-enhanced, earless flange, single-ended	Tape & Reel, 250 pcs

Typical Performance

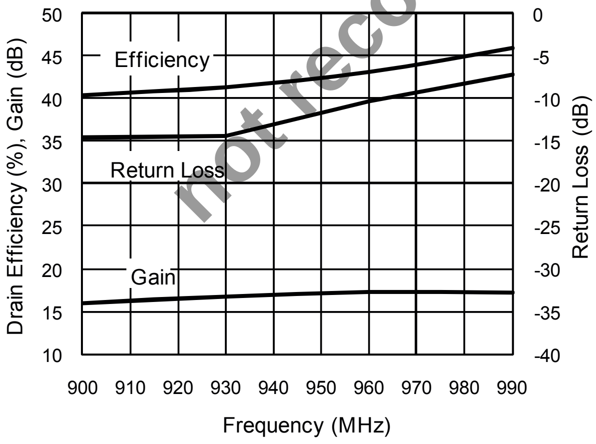
CW Performance
Gain & Efficiency vs. Output Power
V_{DD} = 30 V, I_{DQ} = 1.85 A, ƒ = 960 MHz



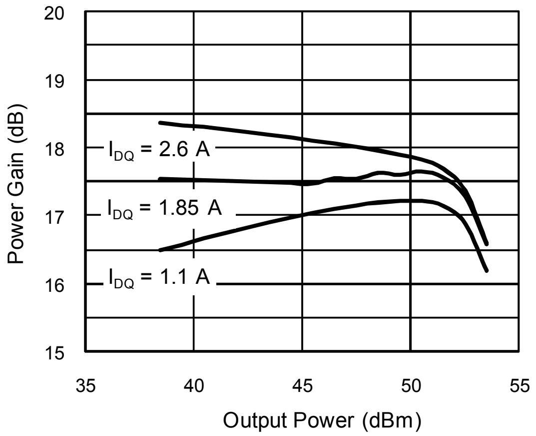
CW Performance
Gain & Efficiency vs. Output Power
V_{DD} = 30 V, I_{DQ} = 1.85 A, ƒ = 960 MHz



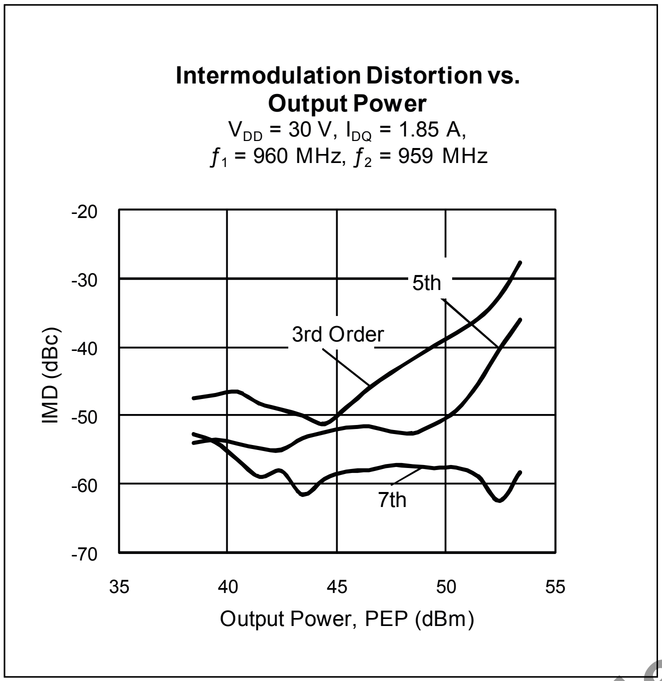
Broadband Two-tone
Gain, Efficiency & Return Loss
vs. Frequency
V_{DD} = 30 V, I_{DQ} = 1.85 A, P_{OUT} = 110 W



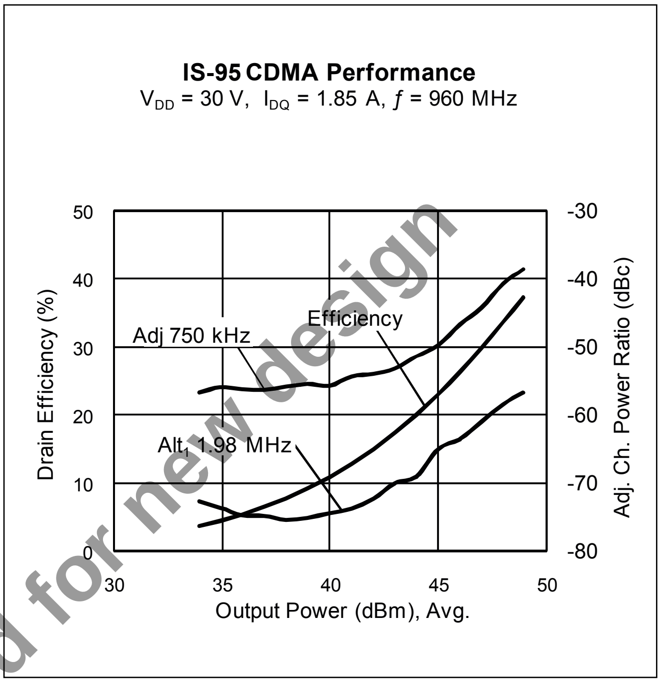
Power Sweep, CW
V_{DD} = 30 V, ƒ = 960 MHz



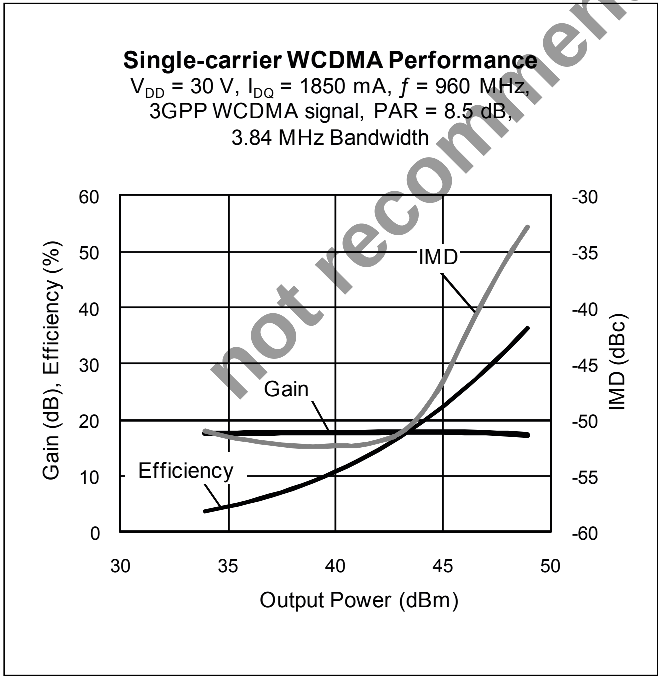
Typical Performance (cont.)



Intermodulation Distortion vs. Output Power
V_{DD} = 30 V, I_{DQ} = 1.85 A,
f_1 = 960 MHz, f_2 = 959 MHz

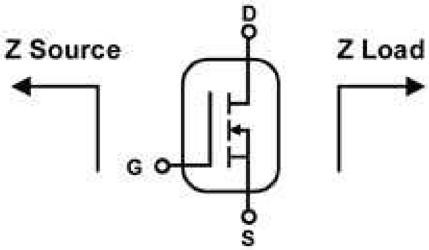


IS-95 CDMA Performance
V_{DD} = 30 V, I_{DQ} = 1.85 A, f = 960 MHz

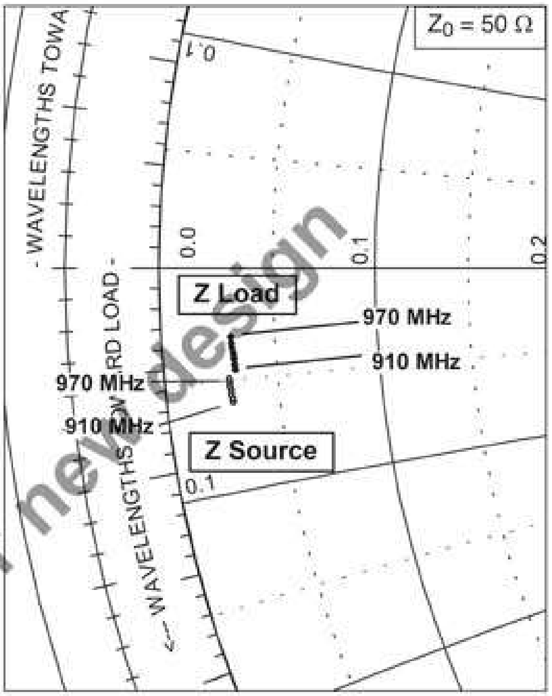


Single-carrier WCDMA Performance
V_{DD} = 30 V, I_{DQ} = 1850 mA, f = 960 MHz,
3GPP WCDMA signal, PAR = 8.5 dB,
3.84 MHz Bandwidth

Broadband Circuit Impedance

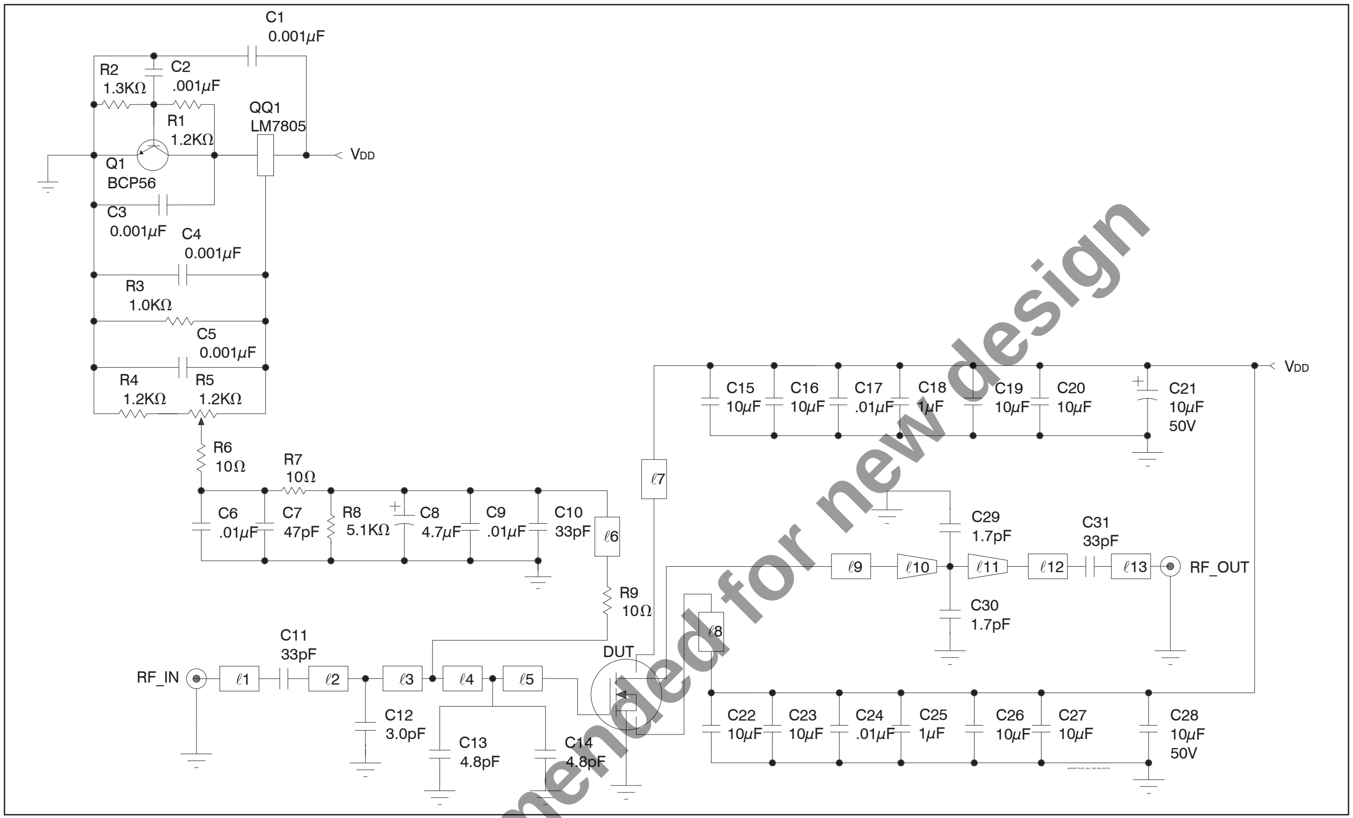


Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
910	1.44	–3.01	1.57	–2.30
920	1.43	–2.92	1.56	–2.18
930	1.42	–2.83	1.55	–2.05
940	1.42	–2.74	1.54	–1.93
950	1.41	–2.66	1.53	–1.81
960	1.41	–2.57	1.52	–1.69
970	1.41	–2.48	1.51	–1.56



See next page for reference circuit information

Reference Circuit



Reference circuit block diagram for ƒ = 960 MHz

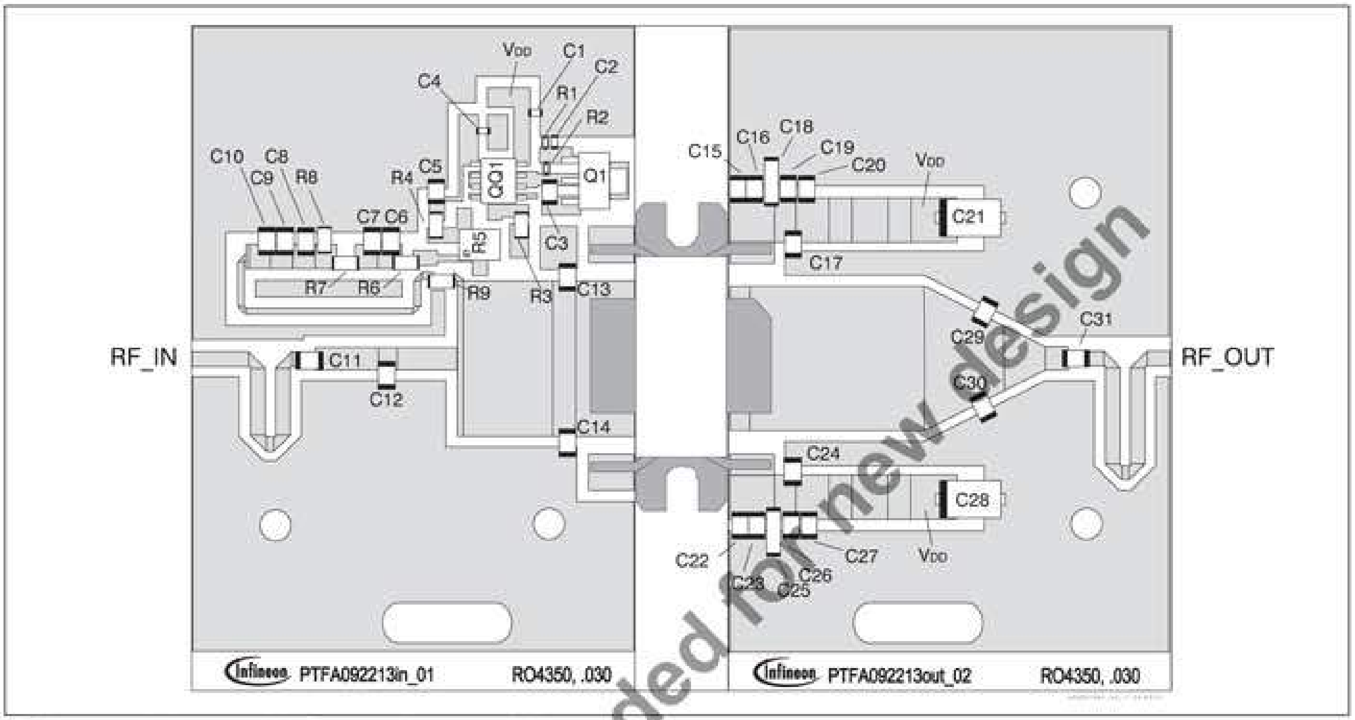
Circuit Assembly Information

DUT	PTFA092213EL or PTFA092213FL	
PCB	LTN/PTFA092213EF	0.76 mm [.030"] thick, εr = 3.48, Rogers RO4350, 1 oz. copper

Electrical Characteristics at 960 MHz

Transmission Line	Electrical Characteristics	Dimensions: L x W (mm)	Dimensions: L x W (in.)
ℓ1	0.167 λ, 50.1 Ω	31.75 x 1.65	1.250 x 0.065
ℓ2	0.047 λ, 38.0 Ω	8.38 x 2.54	0.330 x 0.100
ℓ3	0.039 λ, 38.0 Ω	7.37 x 2.54	0.290 x 0.100
ℓ4	0.072 λ, 7.8 Ω	12.45 x 17.78	0.490 x 0.700
ℓ5	0.046 λ, 7.8 Ω	7.87 x 17.78	0.310 x 0.700
ℓ6	0.163 λ, 78.3 Ω	31.75 x 0.74	1.250 x 0.029
ℓ7, ℓ8	0.043 λ, 23.5 Ω	7.75 x 4.95	0.305 x 0.195
ℓ9	0.130 λ, 8.3 Ω	22.61 x 16.51	0.890 x 0.650
ℓ10 (taper)	0.032 λ, 8.3 Ω / 11.7 Ω	5.72 x 16.51 / 11.30	0.225 x 0.650 / 0.445
ℓ11 (taper)	0.053 λ, 11.7 Ω / 37.0 Ω	9.78 x 11.30 / 2.64	0.385 x 0.445 / 0.104
ℓ12	0.009 λ, 37.0 Ω	16.51 x 2.64	0.650 x 0.104
ℓ13	0.167 λ, 50.1 Ω	31.75 x 1.65	1.250 x 0.065

Reference Circuit (cont.)



*Reference circuit assembly diagram (not to scale)**

Component	Description	Suggested Manufacturer	P/N
C1, C2, C3, C4, C5	Capacitor, 0.001 μF	Digi-Key	PCC1772CT-ND
C18, C25	Capacitor, 1 μF	ATC	920C105
C8	Capacitor, 4.7 μF, 16 V	Digi-Key	PCS3475CT-ND
C6, C9, C17, C24	Capacitor, 0.01 μF	ATC	200B 103
C15, C16, C19, C20, C22, C23, C26, C27	Tantalum Capacitor, 10 μF, 50 V	Garrett Electronics	TPSE106K050R0400
C21, C28	Tantalum Capacitor, 10 μF, 50 V	Digi-Key	P5571-ND
C29, C30	Ceramic Capacitor, 1.7 pF	ATC	100B 1R7
C13, C14	Ceramic Capacitor, 4.8 pF	ATC	100B 4R8
C12	Ceramic Capacitor, 3.0 pF	ATC	100B 3R0
C10, C11, C31	Ceramic Capacitor, 33 pF	ATC	100B 330
C7	Ceramic Capacitor, 47 pF	ATC	100B 470
Q1	Transistor	Infineon Technologies	BCP56
QQ1	Voltage Regulator	National Semiconductor	LM7805
R1, R4	Chip Resistor, 1.2 k Ω	Digi-Key	P1.2KGCT-ND
R2	Chip Resistor, 1.3 k Ω	Digi-Key	P1.3KGCT-ND
R3	Chip Resistor, 2 k Ω	Digi-Key	P2KECT-ND
R5	Potentiometer, 2 k Ω	Digi-Key	3224W-202ETR-ND
R8	Chip Resistor, 5.1 k Ω	Digi-Key	P5.1KECT-ND
R6, R7, R9	Chip Resistor, 10 Ω	Digi-Key	P10ECT-ND

** Gerber Files for this circuit available on request*

Package Outline Specifications

Package H-33288-6

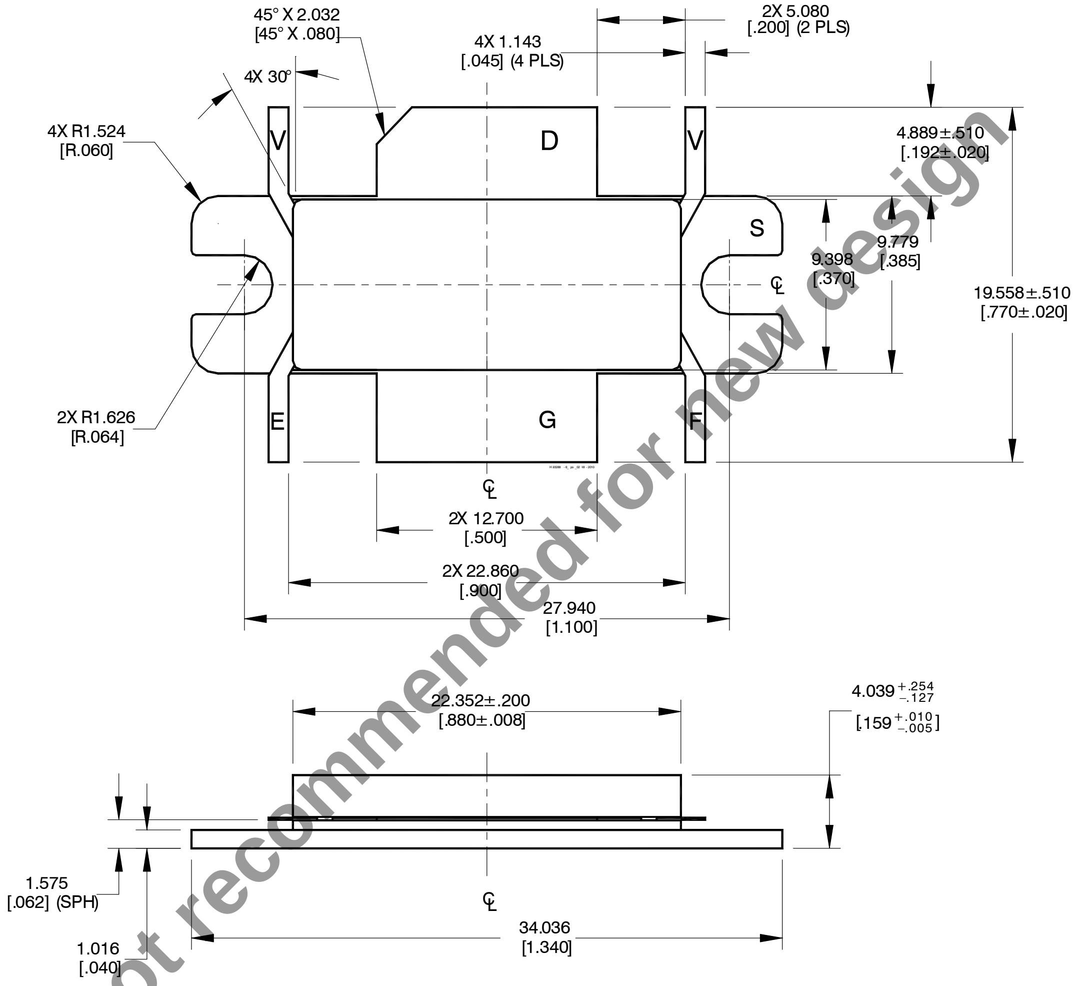


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994.
2. Primary dimensions are mm. Alternate dimensions are inches.
3. All tolerances ± 0.127 [.005] unless specified otherwise.
4. Pins: A = gate, B = source, C = drain, D = V_{DD}, E, F = N.C.
5. Lead thickness: 0.10 + 0.051/–0.025 mm [.004 +0.002/–0.001 inch].
6. Gold plating thickness: 0.25 micron [10 microinch] max.

Package Outline Specifications (cont.)

Package H-34288-4/2

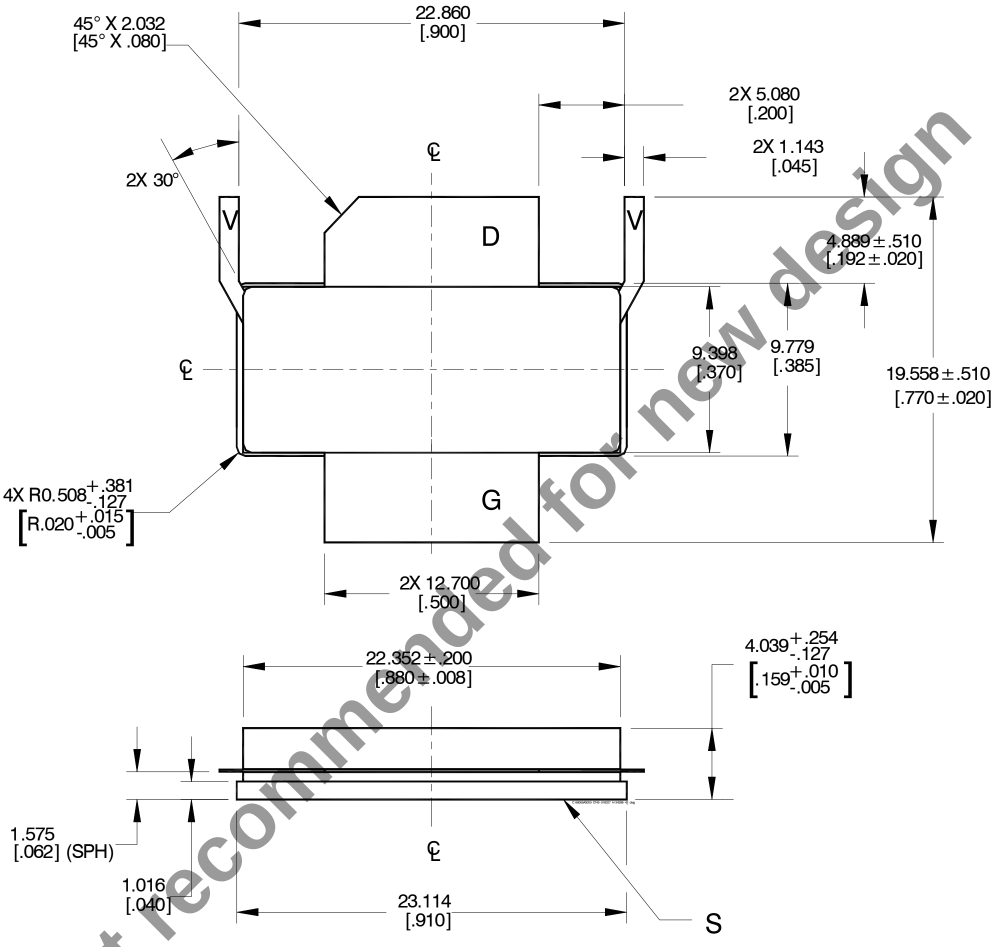


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994.
2. Primary dimensions are mm. Alternate dimensions are inches.
3. All tolerances ± 0.127 [.005] unless specified otherwise.
4. Pins: D = drain; S = source; G = gate; V = V_{DD}.
5. Lead thickness: 0.10 + 0.051/–0.025 mm [.004 +0.002/–0.001 inch].
6. Gold plating thickness: 0.25 micron [10 microinch] max.

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Revision History: 2015-03-04 Data Sheet

Previous Version: 2010-11-04, Data Sheet

Page	Subjects (major changes since last revision)
All	Not recommended for new design

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