

General Description

The MAX4815/MAX4816/MAX4817 high-bandwidth, low-on-resistance, quad-SPST analog switches are designed to serve as integrated T1/E1 protection switches for 1+1 and N+1 line-card redundancy applications. Each MAX4815/MAX4816/MAX4817 replaces four electromechanical relays, significantly reducing board space, simplifying PC board routing, and reducing power consumption. These devices operate with ±3.3V or ±5V dual supplies for applications requiring T1/E1 signal switching in the line side of the interface transformer. Internal voltage multipliers drive the analog switches, yielding excellent linearity and low 3.7Ω typical on-resistance within the T1/E1 analog signal range. This high-bandwidth (550MHz typical) family of products is optimized for low return loss and matched pulse template performance in T1/E1 long-haul and short-haul applications.

The MAX4815/MAX4816/MAX4817 are available in a tiny 16-pin, 5mm x 5mm, thin QFN package and are specified over the extended -40°C to +85°C temperature range.

Applications

T1/E1 Redundancy Switching

Base Stations and Base-Station Controllers

Add and Drop Multiplexers

Multiservice Provisioning Platforms

Edge Routers

Multiservice Switches (MSSs)

Digital Loop Carriers

Industrial Applications

Data Acquisition

Telecom Signal Switching

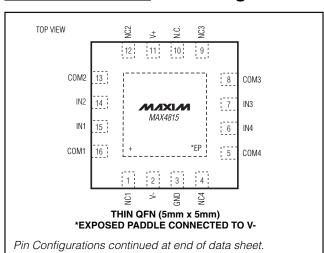
Test Equipment

Avionics

Features

- ♦ Quad-SPST NO, NC, and NC/NO Configurations
- ♦ Dual-Supply Operation from ±3.3V to ±5V
- ♦ Single-Supply Operation from +6V to +11V
- ♦ Hot Insertion Tolerant with No DC Path to the **Supplies**
- ♦ Low On-Resistance, $R_{ON} = 3.7\Omega$ (typ) and 6Ω
- ♦ Over 550MHz, -3dB Signal Bandwidth
- **♦ Excellent Crosstalk and Off-Isolation Performance** Over the T1/E1 Signal Spectrum: 110dB Crosstalk Attenuation at 1MHz
- **♦** Low Current Consumption of 2mA (max)
- ♦ -40°C to +85°C Extended Temperature Range
- ♦ Space-Saving, 16-Pin, 5mm x 5mm Thin QFN

Pin Configurations



Ordering Information

PART	TEMP RANGE	PIN-PACKAGE	CONFIGURATION	PKG CODE
MAX4815ETE+	-40°C to +85°C	16 TQFN-EP*	4 x SPST NC	T1655-3
MAX4816ETE+	-40°C to +85°C	16 TQFN-EP*	4 x SPST NO	T1655-3
MAX4817ETE+	-40°C to +85°C	16 TQFN-EP*	4 x SPST NC/NO	T1655-3

*EP = Exposed paddle.

Devices are available in lead-free packaging.

ABSOLUTE MAXIMUM RATINGS

erwise noted.)
0.3V to +6V
6V to +0.3V
0.3V to +12V
0.3V to $(V+ + 0.3V)$
12V to +12V
18V to +18V
±100mA
±30mA

Peak Current (NO_, NC_, COM_) (pulsed at 1ms, 10% duty cycle) Continuous Power Dissipation (T _A = +70°(16-Pin Thin QFN 5mm x 5mm (derate 33	C)
above +70°C)	2667mW 40°C to +85°C 65°C to +150°C +150°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS—Dual ±3.3V Supplies

 $(V+ = +3.3V \pm 10\%, V- = -3.3V \pm 10\%, T_A = T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise noted.}$ Typical values are at $T_A = +25^{\circ}C.$) (Note 1)

PARAMETER	SYMBOL	CONDIT	TIONS	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Fault-Free Analog Signal Range	VCOM_ VNO_ VNC_			V-		V+	V
On Registance (Note 2)	Povi	V+ = +3V, V- = -3V,	T _A = +25°C		3.7	5	Ω
On-Resistance (Note 2)	Ron	I _{COM_} = 30mA, V _{NO_} or V _{NC_} = +3V	$T_A = T_{MIN}$ to T_{MAX}			6	22
On-Resistance Match	AD	V+ = +3V, V- = -3V,	T _A = +25°C		0.1	0.6	Ω
Between Channels (Notes 2, 3)	ΔR _{ON}	I _{COM} _ = 30mA, V _{NO} _ or V _{NC} _ = +3V	$T_A = T_{MIN}$ to T_{MAX}			0.8	22
On-Resistance Flatness	D	V+ = +3V, V- = -3V, $I_{COM} = 30mA;$	T _A = +25°C		0.4	1.2	
(Notes 2, 4)	R _{FLAT} (ON)	V _{NO} or V _{NC} = -3V, 0V, +3V	$T_A = T_{MIN}$ to T_{MAX}			1.5	Ω
NO or NC Off-Leakage Current	INO_(OFF)	V+ = +3.6V, V- = -3.6V; VCOM_ = -3V, +3V; VNO_ or V _{NC_} = +3V, -3		-10		+10	nA
COM Off-Leakage Current	ICOM_(OFF)	V+ = +3.6V, V- = -3.6V; VCOM_ = -3V, +3V; VNO_ or VNC_ = +3V, -3		-10		+10	nA
COM On-Leakage Current	ICOM_(ON)	V+ = +3.6V, V- = -3.6V; VCOM_ = -3V, +3V; NO_ or NC_ unconnect		-15		+15	nA
FAULT	•						
Fault Analog Signal Range	VCOM_	V+ = +3.3V, V- = -3.3V		-11		+11	V

ELECTRICAL CHARACTERISTICS—Dual ±3.3V Supplies (continued)

 $(V+ = +3.3V \pm 10\%, V- = -3.3V \pm 10\%, T_A = T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise noted. Typical values are at } T_A = +25^{\circ}\text{C.})$ (Note 1)

PARAMETER	SYMBOL	CONDI	TIONS	MIN	TYP	MAX	UNITS
NO or NC Off-Leakage Current	I _{NO} _ I _{NC} _	V+ = +3.3V, V- = -3.3V; V _{NC} _ = +11V, -11V; V _{CC}	- -	-1		+1	μΑ
COM Off-Leakage Current	I _{COM} _	V+ = +3.3V, V- = -3.3V; V _{NO} _ or V _{NC} _ = -5.5V,		-1		+1	μΑ
SWITCH DYNAMIC CHARACTE	RISTICS						
Crosstalk (Note 5)	V _{CT1}	$R_L = 50\Omega$, $f = 1.024MH$	lz, Figure 4		110		dB
Crossiaik (Note 5)	V _{CT2}	$R_L = 50\Omega$, $f = 30MHz$, f	igure 4		77		uБ
Off In alating (Nata 0)	V _{ISO1}	V_{COM} to V_{NO} or V_{NC} $R_L = 50\Omega$, $f = 1.024MH$			60		-10
Off-Isolation (Note 6)	V _{ISO2}	V_{COM} to V_{NO} or V_{NC} $R_L = 50\Omega$, $f = 30MHz$, I			30		dB
On-Channel -3dB Bandwidth	BW	$R_S = R_L = 50\Omega$, Figure	4		550		MHz
COM On-Capacitance	Con(com_)	f = 1MHz, Figure 5			10		рF
COM Off-Capacitance	Coff(COM_)	f = 1MHz, Figure 5			7		рF
NC/NO Off-Capacitance	Coff	f = 1MHz, Figure 5			7		рF
Charge Injection	Q	$C_L = 1.0 nF, V_{GEN} = 0,$	R _{GEN} = 0, Figure 3		55		рС
Fault Recovery Time	trec	V _{NO_} , V _{NC_} , V _{COM_} = -	-11V		128		μs
Turn-On Time	ton	V_{NO} or V_{NC} = +3V, R_L = 300 Ω ,	T _A = +25°C		20	40	μs
		$C_L = 35pF$, Figure 2	$T_A = T_{MIN}$ to T_{MAX}			40	· ·
Turn-Off Time	toff	V_{NO} or V_{NC} = +3V, R_L = 300 Ω ,	T _A = +25°C		0.5	1	μs
		$C_L = 35pF$, Figure 2	$T_A = T_{MIN}$ to T_{MAX}			1	· ·
Power-Up Delay	tDEL				128		μs
LOGIC INPUT (IN_)							
Input-Voltage Low	VIL					0.8	V
Input-Voltage High	VIH			2.4			V
Input Leakage Current	I _{IN}	$V_{IN} = 0$ or $V+$		-1		+1	μΑ
POWER SUPPLY							
Quiescent Positive Supply Current	l+	V+ = +3.6V, V- = -3.6V	, V _{IN} _ = 0 or V+		0.8	2	mA
Quiescent Negative Supply Current	l-	V+ = +3.6V, V- = -3.6V	, V _{IN} _ = 0 or V+		0.8	2	mA
Negative Supply Voltage	V-			-3.6		-3.0	V
Positive Supply Voltage	V+			3.0		3.6	V

ELECTRICAL CHARACTERISTICS—Dual ±5V Supplies

 $(V+=+5V \pm 10\%, V-=-5V \pm 10\%, T_A=T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise noted. Typical values are at } T_A=+25^{\circ}\text{C.})$ (Note 1)

PARAMETER	SYMBOL	CONDITIO	NS	MIN	TYP	MAX	UNITS
ANALOG SWITCH	•			-			•
Fault-Free Analog Signal Range	VCOM_ VNO_ VNC_			V-		V+	V
		V+ = +4.5V, V- = -4.5V,	T _A = +25°C		3.7	5	
On-Resistance (Note 2)	R _{ON}	ICOM_ = 30mA, VNO_ or VNC_ = +3V	$T_A = T_{MIN}$ to T_{MAX}			6	Ω
On-Resistance Match		V+ = +4.5V, V- = -4.5V,	$T_A = +25^{\circ}C$		0.1	0.6	
Between Channels (Notes 2, 3)	ΔR _{ON}	ICOM_ = 30mA, V _{NO_} or V _{NC_} = +3V	T _A = T _{MIN} to T _{MAX}			0.8	Ω
On-Resistance Flatness	R _{FLAT} (ON)	V+ = +4.5V, V- = -4.5V, $I_{COM} = 30mA;$	T _A = +25°C		0.4	1.2	Ω
(Notes 2, 4)	nflat(ON)	V_{NO} or $V_{NC} = -3V$, $0V$, $+3V$	$T_A = T_{MIN}$ to T_{MAX}			1.5	52
NO or NC Off-Leakage Current	INO_(OFF)	V+ = +5.5V, V- = -5.5V; VCOM_ = -5V, +5V; VNO_ or VNC_ = +5V, -5V		-10		+10	nA
COM Off-Leakage Current	ICOM_(OFF)	V+ = +5.5V, V- = -5.5V; VCOM_ = -5V, +5V; VNO_ or VNC_ = +5V, -5V		-10		+10	nA
COM On-Leakage Current	I _{COM_(ON)}	V+ = +5.5V, V- = -5.5V; VCOM_ = -5V, +5V; NO_ or NO_ unconnected		-15		+15	nA
FAULT							
Fault Analog Signal Range	VCOM_ VNO_ VNC_	V+ = +5V, V- = -5V		-11		+11	V
NO or NC Off-Leakage Current	I _{NO} _	V+ = +5V, V- = -5V; V _{NO_} or V _{NC_} = +11V, -11 V _{COM_} = -5.5V, +5.5V	V;	-1		+1	μΑ
COM Off-Leakage Current	Ісом_	V+ = +5V, V- = -5V; VCOM_ = +11V, -11V; VNO_ or VNC_ = -5.5V, +5.	5V	-1		+1	μΑ
SWITCH DYNAMIC CHARACTER	RISTICS		-				
Crosstalk (Note 5)	V _{CT1}	$R_L = 50\Omega$, $f = 1.024MHz$, I	Figure 4		110		dB
5.555tan (116t6 5)	V _{CT2}	$R_L = 50\Omega$, $f = 30MHz$, Figure	ure 4		77		

ELECTRICAL CHARACTERISTICS—Dual ±5V Supplies (continued)

 $(V+ = +5V \pm 10\%, V- = -5V \pm 10\%, T_A = T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise noted. Typical values are at } T_A = +25^{\circ}\text{C.})$ (Note 1)

PARAMETER	SYMBOL	CONDIT	TONS	MIN	TYP	MAX	UNITS
Off-Isolation (Note 6)	V _{ISO1}	V_{COM} to V_{NO} or V_{NC} $R_L = 50\Omega$, $f = 1.024MH$	•		60		- dB
On-isolation (Note 0)	V _{ISO2}	V_{COM} to V_{NO} or V_{NC} $R_L = 50\Omega$, $f = 30MHz$, F	•		30		QD.
On-Channel -3dB Bandwidth	BW	$R_S = R_L = 50\Omega$, Figure 4	4		550		MHz
COM On-Capacitance	CON(COM_)	f = 1MHz, Figure 5			10		рF
COM Off-Capacitance	Coff(COM_)	f = 1MHz, Figure 5			7		рF
NC/NO Off-Capacitance	Coff	f = 1MHz, Figure 5			7		рF
Charge Injection	Q	$C_L = 1.0nF, V_{GEN} = 0, F$	R _{GEN} = 0, Figure 3		55		рС
Fault Recovery Time	trec	V _{NO_} , V _{NC_} , V _{COM_} = -	11V		128		μs
		V_{NO} or $V_{NC} = +3V$,	$T_A = +25^{\circ}C$		20	40	
Turn-On Time	ton	$R_L = 300\Omega$, $C_L = 35pF$, Figure 2	$T_A = T_{MIN}$ to T_{MAX}			40	μs
		V_{NO} or $V_{NC} = +3V$,	T _A = +25°C		0.5	1	
Turn-Off Time	toff	$R_L = 300\Omega$, $C_L = 35pF$, Figure 2	TA = T _{MIN} to T _{MAX}			1	μs
Power-Up Delay	tDEL				128		μs
LOGIC INPUT (IN_)							
Input-Voltage Low	VIL					0.8	V
Input-Voltage High	VIH			2.4			V
Input Leakage Current	I _{IN}	$V_{IN} = 0$ or $V+$		-1		+1	μΑ
POWER SUPPLY							_
Quiescent Positive Supply Current	l+	V+ = +5.5V, V- = -5.5V,	$V_{IN} = 0$ or $V+$		0.9	2	mA
Quiescent Negative Supply Current	I-	V+ = +5.5V, V- = -5.5V,	V _{IN} _ = 0 or V+		0.9	2	mA
Negative Supply Voltage	V-			-5.5		-4.5	V
Positive Supply Voltage	V+			4.5		5.5	V

Note 1: All parameters are production tested at T_A = +85°C and guaranteed by design over specified temperature range.

Note 2: Guaranteed by design, not production tested.

Note 3: $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$.

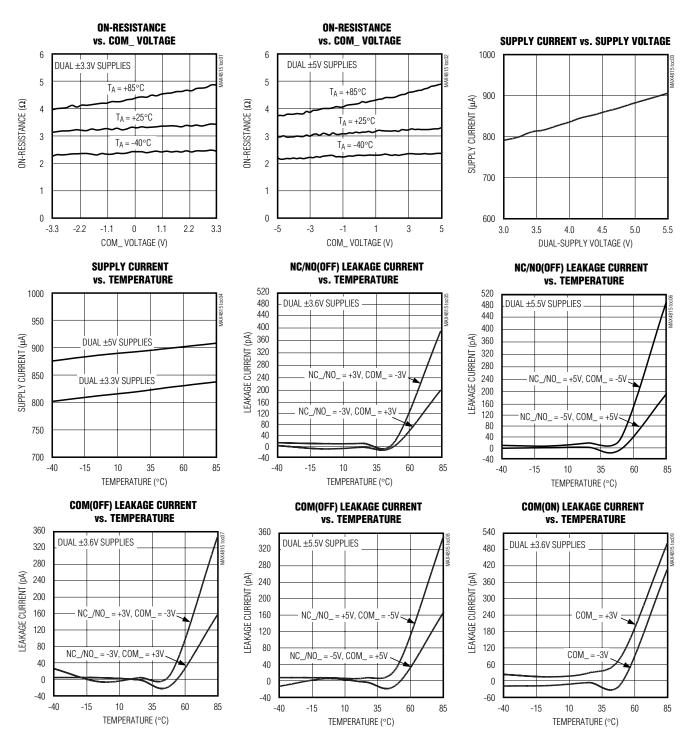
Note 4: Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal range.

Note 5: Between any two switches.

Note 6: Off-isolation = 20 x log₁₀ [V_{COM}_(V_{NC}_ or V_{NO}_)], V_{COM}_ = output, V_{NC}_ or V_{NO}_ = input to OFF switch.

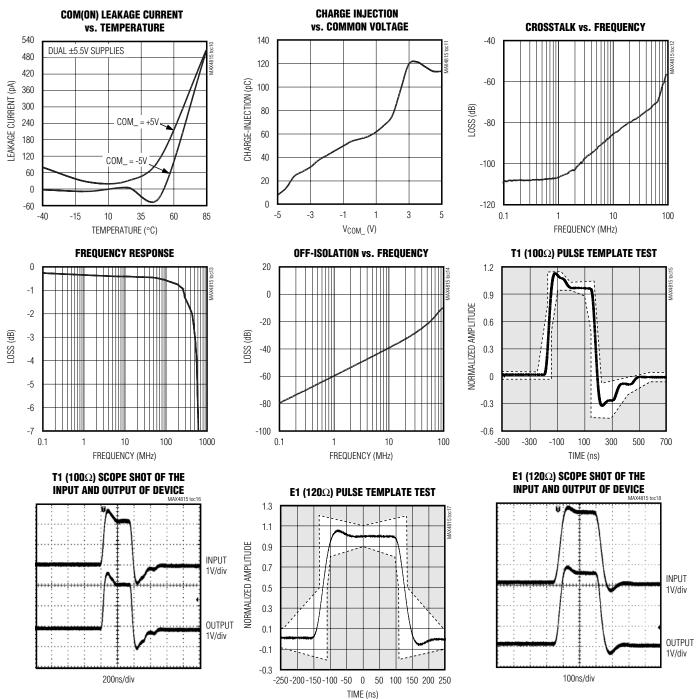
Typical Operating Characteristics

 $(V+ = +3.3V, V- = -3.3V, T_A = +25$ °C, unless otherwise noted.)



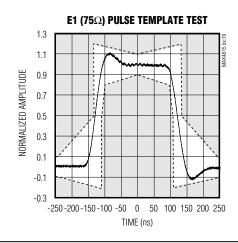
Typical Operating Characteristics (continued)

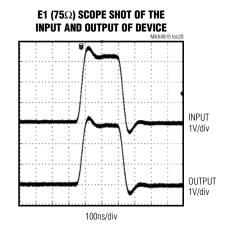
 $(V+ = +3.3V, V- = -3.3V, T_A = +25^{\circ}C, unless otherwise noted.)$



Typical Operating Characteristics (continued)

(V+ = +3.3V, V- = -3.3V, T_A = +25°C, unless otherwise noted.)





Pin Description

	PIN		NAME	FUNCTION
MAX4815	MAX4816	MAX4817	NAME	FUNCTION
1	_	_	NC1	Analog Switch Normally Closed Terminal 1
2	2	2	V-	Negative Supply Voltage. Bypass V- to ground with a 0.1µF ceramic capacitor.
3	3	3	GND	Ground
4	_	_	NC4	Analog Switch Normally Closed Terminal 4
5	5	5	COM4	Analog Switch Common Terminal 4
6	6	6	IN4	Switch 4 Logic-Control Input
7	7	7	IN3	Switch 3 Logic-Control Input
8	8	8	COM3	Analog Switch Common Terminal 3
9	_	9	NC3	Analog Switch Normally Closed Terminal 3
10	10	10	N.C.	No Connection. Not internally connected.
11	11	11	V+	Positive Supply Voltage. Bypass V+ to ground with a 0.1µF ceramic capacitor.
12	_	12	NC2	Analog Switch Normally Closed Terminal 2
13	13	13	COM2	Analog Switch Common Terminal 2
14	14	14	IN2	Switch 2 Logic-Control Input
15	15	15	IN1	Switch 1 Logic-Control Input
16	16	16	COM1	Analog Switch Common Terminal 1
_	1	1	NO1	Analog Switch Normally Open Terminal 1
_	4	4	NO4	Analog Switch Normally Open Terminal 4
	9	_	NO3	Analog Switch Normally Open Terminal 3
	12	_	NO2	Analog Switch Normally Open Terminal 2
EP	EP	EP	EP	Exposed Paddle. Connect exposed paddle to V- or leave unconnected.

8 ______ *NIXIM*

Detailed Description

The MAX4815/MAX4816/MAX4817 are high-bandwidth, low-on-resistance, quad-SPST analog switches targeted to serve as integrated T1/E1 analog protection switches for 1+1 and N+1 line-card redundancy applications. These devices are designed to replace electromechanical relays to save board space, reduce power consumption, and simplify PC board routing. The devices allow the user to live insert the boards with no adverse effects.

The MAX4815/MAX4816/MAX4817 support $\pm 3.3V$ or $\pm 5V$ dual-supply operation, which is required for E1/T1 signal switching in the line-side of the interface transformer. Internal voltage multipliers supply the switches yielding excellent linearity and low on-resistance, typically 3.7Ω , within the E1/T1 analog signal range. This high-bandwidth, typically 550MHz, family of devices is optimized for low return loss and matched pulse template performance in E1/T1 short-haul and long-haul applications.

Analog Signal Levels

The on-resistance of the MAX4815/MAX4816/MAX4817 is very low and stable as the analog signals are swept from V- to V+ (see the *Typical Operating Characteristics*).

Fault Protection

The fault protection of the MAX4815/MAX4816/ MAX4817 allows the devices to handle input signals of more than twice the supply voltage without clamping the signal, latching up, or disturbing other cards in the system. The device detects when the input voltage drops below the negative supply. As soon as a fault condition is detected, the switch is immediately turned off for 128 clock cycles (typically 128µs). At the end of the 128µs timeout, the switch is turned back on for one clock cycle. At the end of the one clock cycle, if the signal is within the operating range, the switch will remain on. Otherwise, the device will turn the switch off again for 128 clock cycles. This will repeat until the signal is within the operating range. In T1/E1 redundancy applications, this can happen when the load resistor (RL) is removed or disconnected for any reason, as shown in Figure 1. Without a load resistor, the output voltage when using a 1:2 transformer can be as high as $\pm 11V$.

Hot Insertion

The MAX4815/MAX4816/MAX4817 tolerate hot insertions, thus are not damaged when inserted into a live backplane. Competing devices can exhibit low impedance when plugged into a live backplane that can cause high power dissipation leading to damage of the device itself. The MAX4815/MAX4816/MAX4817 have relatively high input impedance when V+ and V- are

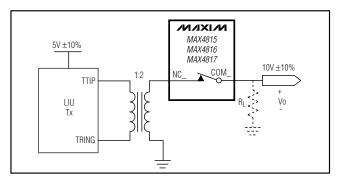


Figure 1. Fault Protection

unconnected or connected to GND. Therefore, the devices are not destroyed by a hot insertion. In order to guarantee data integrity, the V+ and V- supplies must be properly biased.

Applications Information

T1/E1 N+1 Redundancy

The MAX4815/MAX4816/MAX4817 are designed for adjacent line-card protection applications. Figures 6 and 7 show a basic architecture for twisted-pair interface (120Ω E1, or 100Ω T1). Coaxial cable interface (75Ω E1) can be illustrated with the same figures but without the single-ended-to-differential conversion stage. A single protection card can replace up to N line cards in a N+1 redundancy scheme. Figure 6 shows the MAX4815/MAX4816/MAX4817 sitting in the line cards where they can reroute any of the input/output signals to a protection line card. Figure 7 shows the MAX4815/MAX4816/MAX4817 sitting in a protection-switching card where the switches are always powered. These figures do not show the surge protection elements and resistors for line termination/impedance matching.

The low on-resistance and high bandwidth of the MAX4815/MAX4816/MAX4817 yield good pulse template and return-loss performance (see the Typical Operating Characteristics). The pulse template tests for E1 (twisted pair interface 120Ω and coaxial interface 75 Ω) and T1 (twisted pair interface 100 Ω) were tested using the Dallas DS2155 single-chip transceiver evaluation board, and twelve switches in parallel with one switch closed and the other eleven open. The internal transmit termination feature must be disabled when using this circuit. To use the same transmit resistors for E1 twisted pair and coaxial cables, the transmit line build out control register (TLBC) is set to the value 6Ah. This sets the driver voltage so the output pulse has the right amplitude for both 120Ω (twisted pair) and 75Ω (coaxial) loads. The analog switches were powered with dual power supplies at ±5V.

Test Circuits/Timing Diagrams

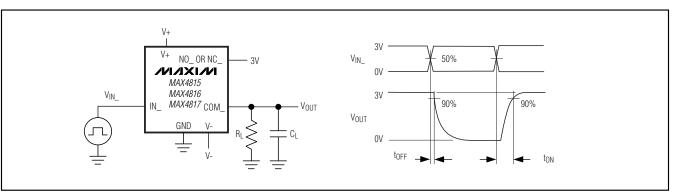


Figure 2. Switch Turn-On/Turn-Off Times

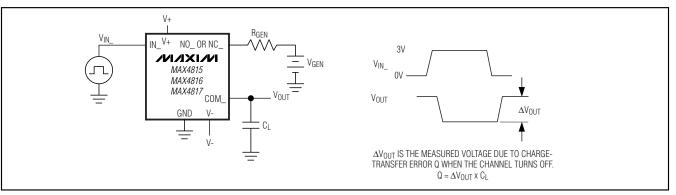


Figure 3. Charge Injection

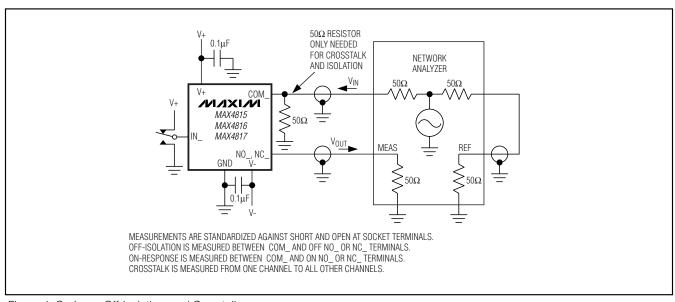


Figure 4. On-Loss, Off-Isolation, and Crosstalk

10 ______/N/XI/VI

Test Circuits/Timing Diagrams (continued)

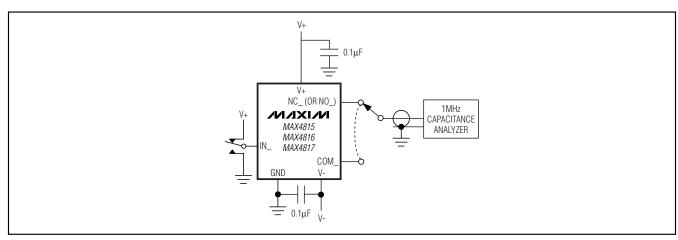


Figure 5. Channel Off-/On-Capacitance

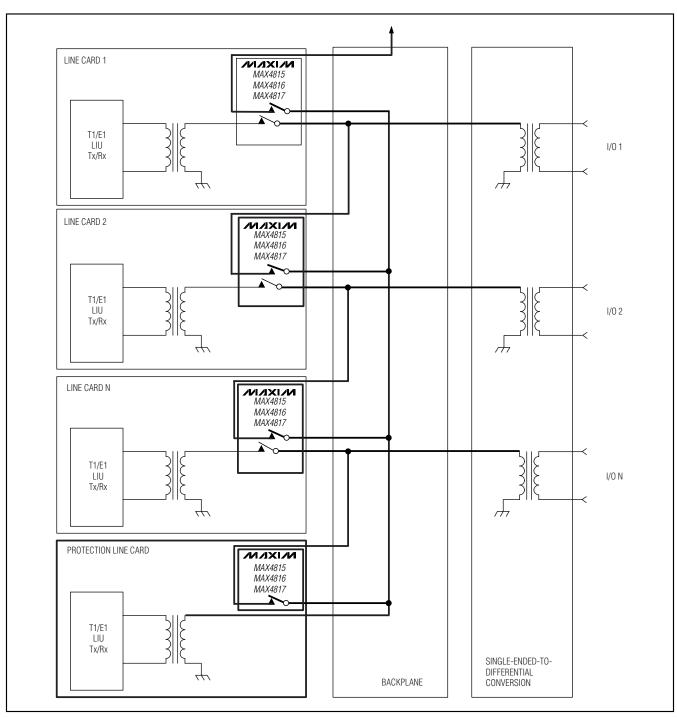


Figure 6. Adjacent Line-Card Protection Architecture with Switches in the Line Cards for Twisted Pair Cable (120 Ω E1, or 100 Ω T1). Figure for coaxial cable (75 Ω E1) is the same without the single-ended-to-differential conversion.

12 ______/N/XI/M

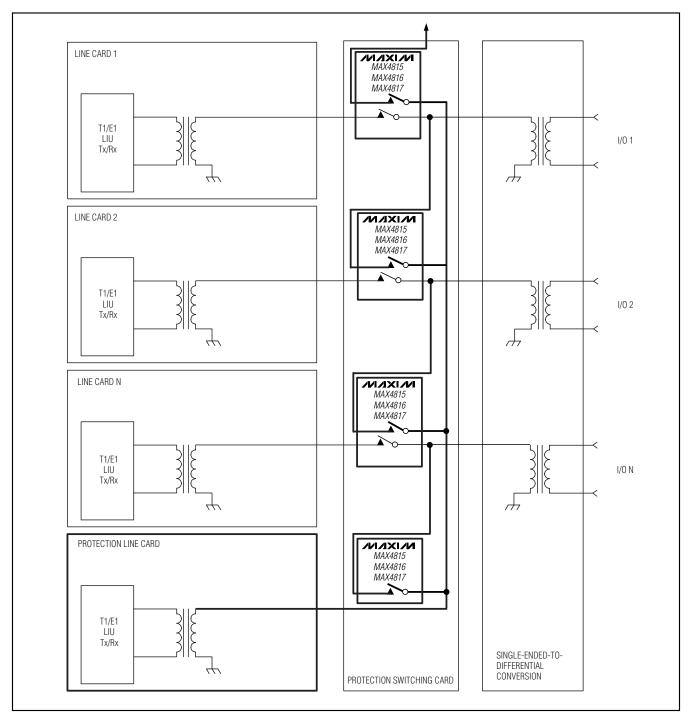
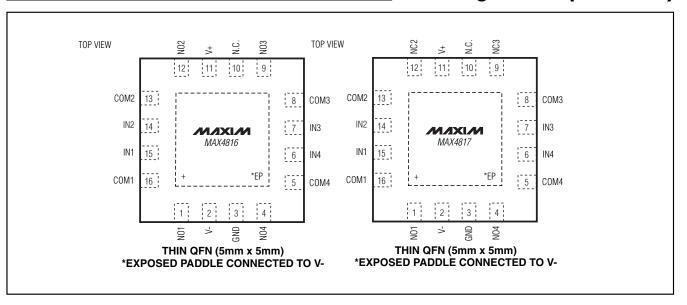


Figure 7. Adjacent Line-Card Protection Architecture with Switches out of the Line Cards for Twisted Pair Cable (120 Ω E1, or 100 Ω T1). Figure for coaxial cable (75 Ω E1) is the same without the single-ended-to-differential conversion.

Pin Configurations (continued)

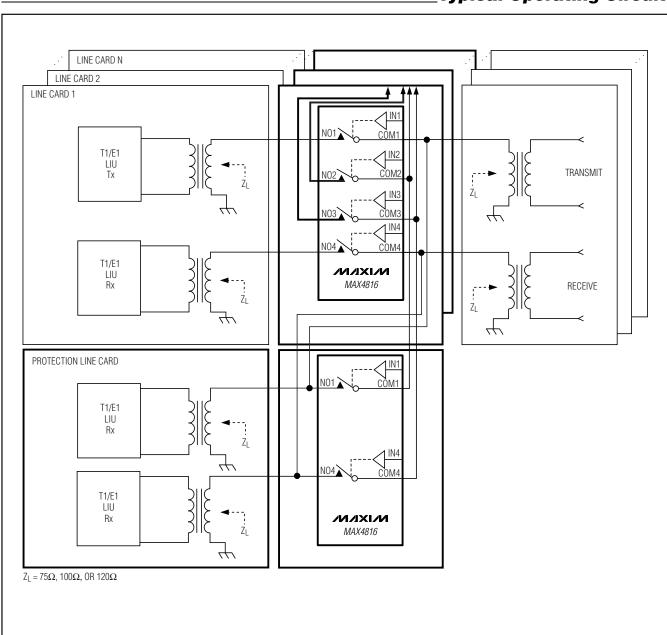


_Chip Information

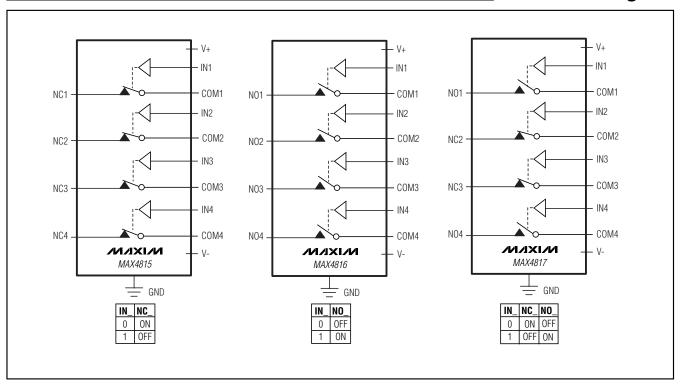
PROCESS: BICMOS

CONNECT EXPOSED PADDLE TO V-.

Typical Operating Circuit



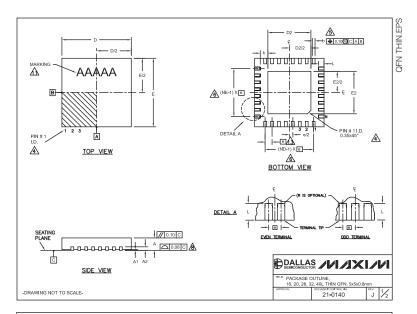
Functional Diagram



16 ______/N/XI/M

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to www.maxim-ic.com/packages.)



		CO	MON	DIMEN	SIONS	3										EXI	POSE	D PAD	VARI	4OITA	NS	
PKG.	16L 5x5		20L :			8L 5x			32L 5			IOL 5x5		-	PKG.		D2			E2		1
SYMBOL	MIN. NOM.	_	_	_	_	$\overline{}$			_	_	_	_		Ċ	CODES	MIN.	NOM	MAX.	MIN	NOM	. MAX	đ
A	0.70 0.75	0.80 0	70 0.7	5 0.80	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75 0	08.0	T	T1655-2	3.00	3.10	3,20	3.00	3,10	3,20	đ
A1	0 0.02	0.05	0.0	2 0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	Т	T1655-3	3.00	3.10	3.20	3.00	3.10	3.20	7
A2	0.20 REI		0.20 F			20 RE			.20 RI			20 REF		Т	T1655N-1	3.00	3.10	3,20	3.00	3.10	3.20	7
b	0.25 0.30													T	Γ2055-3	3.00	3.10	3.20	3.00	3.10	3.20	5
D			90 5.0									5.00 5		T	T2055-4	3,00	3,10	3,20	3.00	3,10	3,20	7
E	4.90 5.00 0.80 BS		0.65			5.00 50 BS			5.00 0.50 B			5.00 5		T	T2055-5	3,15	3,25	3,35	3,15	3,25	3,35	5
e k	0.80 BS		25 -	380.	0.25	50 BS	C.	0.25		SU.	0.25	.40 BSt	U.	Ť	T2855-3	3.15	3,25	3,35	3.15	3,25	3,35	f
L			45 0.5			\rightarrow	_			0.50		0.40 0	2.50	T	T2855-4	2.60	2.70	2.80		2.70		
N	16	0.50 0	45 0.5	J [U.00	0.45	28	0.00	0.30	32	10.00	10.30	40	5.50	Ť	T2855-5	2.60	2.70	2.80		2.70		ī l
ND	4	\rightarrow	5		\vdash	7			8		\vdash	10	_	T	T2855-6	3.15	3.25	3.35	3.15	3.25	3.35	5
NE	4	\neg	5			7			8			10		T	T2855-7	2.60	2.70	2,80	2.60	2.70	2.80	7
JEDEC	WHHB		WH	HC	٧	VHHD	-1	٧	WHHE)-2		_		T	T2855-8	3.15	3,25	3,35	3,15	3,25	3,35	5
														Т	T2855N-1	3.15	3.25	3.35	3.15	3.25	3.35	5
																3.00	3 10	3,20	3.00			
															T3255-3		00					
NOTES:														Ī	T3255-4	3.00	3.10	3.20	3.00	3.10	3.20	1
	IENSIONING	& TOLI	ERANCI	NG CC	NFOR	м то	ASMI	E Y14	I.5M-1	994.				Ī	T3255-4 T3255-5	3.00	3.10	3.20 3.20	3.00	3.10 3.10	3.20	0
1. DIM	IENSIONING . DIMENSION													Ī	T3255-4 T3255-5 T3255N-1	3.00 3.00 3.00	3.10 3.10 3.10	3.20 3.20 3.20	3.00 3.00 3.00	3.10 3.10 3.10	3.20 3.20 3.20	
1. DIM 2. ALL		IS ARE	IN MILL	IMETE	RS. Af									T	T3255-4 T3255-5 T3255N-1 T4055-1	3.00 3.00 3.00 3.40	3.10 3.10 3.10 3.50	3.20 3.20 3.20 3.60	3.00 3.00 3.00 3.40	3.10 3.10 3.10 3.50	3.20 3.20 3.20 3.60	
1. DIM 2. ALL 3. N IS	DIMENSION THE TOTAL E TERMINAL	IS ARE NUME #1 IDE	IN MILL ER OF NTIFIER	IMETE TERMI	RS. AF NALS. FERMI	NGLES	S ARE	E IN C	EGR	EES.				T	T3255-4 T3255-5 T3255N-1	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	
1. DIM 2. ALL 3. N IS A THE CO OP	DIMENSION THE TOTAL E TERMINAL NFORM TO J TIONAL, BUT	IS ARE NUME #1 IDE IESD 9:	IN MILL ER OF NTIFIER 5-1 SPP BE LOO	IMETE TERMI R AND 1 -012. E CATED	RS. AF NALS. FERMI DETAIL WITHI	NAL N S OF	UMB TERM	ERIN GINAL JE INI	G CO L #1 II	EES. NVEN DENT	IFIER	ARE		T	T3255-4 T3255-5 T3255N-1 T4055-1	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	3.00 3.00 3.00 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	
1. DIM 2. ALL 3. N IS CO OP IDE	DIMENSION THE TOTAL TERMINAL NFORM TO J TIONAL, BUT NTIFIER MAY MENSION b A	IS ARE NUME #1 IDE IESD 9: MUST Y BE E PPLIES	IN MILL ER OF NTIFIEF S-1 SPP BE LOO THER A	IMETE TERMI R AND 1 -012. E CATED MOLE	RS. AF NALS. TERMI DETAIL WITHI OR M	NAL N S OF IN THE IARKE	UMB TERF ZON	ERIN VINAL VE INI ATUR	G CO L #1 II DICAT	NVEN DENT FED. 1	IFIER THE T	ARE ERMINA	NL #1	T	T3255-4 T3255-5 T3255N-1 T4055-1	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	
1. DIM 2. ALL 3. N IS CO OP IDE DIM 0.28	DIMENSION THE TOTAL TERMINAL NFORM TO J TIONAL, BUT NTIFIER MA MENSION 6 A 5 mm AND 0.	IS ARE NUME #1 IDE IESD 9: MUST Y BE E PPLIES 30 mm	IN MILL ER OF NTIFIEF S-1 SPP BE LOC THER A TO ME FROM	IMETE TERMI R AND 1 -012. [CATED MOLE TALLIZ TERMIN	RS. AF NALS. FERMI DETAIL WITHI OR M ED TE NAL TIE	NAL N S OF IN THE IARKE ERMIN P.	IUMB TERI E ZON D FE	ERIN VINAL VIE INI ATUF ND IS	G CO L #1 II DICAT RE.	NVENDENT TED. 1	IFIER THE T	ARE ERMINA IWEEN	NL #1	T T	T3255-4 T3255-5 T3255N-1 T3255N-1 T4055-1 T4055-2	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	
1. DIM 2. ALL 3. N IS CO OP IDE A DIM 0.29	DIMENSION THE TOTAL TERMINAL TERMINAL TIONAL, BUT TIONAL, BUT TIONAL, BUT TOTHER MAY MENSION 6 A 5 mm AND 0.3 AND NE REF	IS ARE NUME #1 IDE IESD 9: MUST Y BE E PPLIES 30 mm	IN MILL ER OF NTIFIEF 1-1 SPP BE LOO THER A TO ME FROM	TERMI R AND 1-012. I CATED MOLE TALLIZ TERMIN	RS. AF NALS. FERMI DETAIL WITHI O OR M ED TE NAL TIE R OF T	NAL N S OF IN THE IARKE ERMIN P.	IUMB TERI E ZON D FE IAL A	ERINI VINAL VE INI ATUF ND IS	DEGRI IG CO L #1 II DICAT RE. S MEA	NVENDENT TED. 1	IFIER THE T	ARE ERMINA IWEEN	NL #1	T T	T3255-4 T3255-5 T3255N-1 T3255N-1 T4055-1 T4055-2	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	
1. DIM 2. ALL 3. N IS CO OP' IDE DIM 0.2: ND 7. DEI	DIMENSION THE TOTAL TERMINAL NFORM TO J TIONAL, BUT NOTIFIER MAY MENSION 6 A T MENSION 10 T T MENSION 10 T T MENSION 10 T T T T T T T T T T T T T T T T T T T	IS ARE NUME #1 IDE IESD 9: MUST Y BE E PPLIES 30 mm ER TO	IN MILL ER OF NTIFIEF 1 SPP BE LOO THER A TO ME FROM THE N SSIBLE	TERMI R AND 1 O12. [CATED MOLE TALLIZ TERMIN UMBER	RS. AF NALS. FERMI DETAIL WITHI O OR M SED TE NAL THE YMME	NAL N S OF IN THE IARKE ERMIN P. ERMIN	IUMB TERI E ZON ID FE IAL A NALS AL FA	ERINGINAL MINAL ME INI ATUF ND IS ON E SHIO	DEGRI IG CO L #1 II DICAT RE. S MEA EACH	NVENDENT FED. 1 SURE D ANI	IFIER THE T D BE	ARE ERMINA TWEEN DE RES	AL #1	T T T	T3255-4 T3255-5 T3255N-1 T3255N-1 T4055-1 T4055-2	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	
1. DIM 2. ALL 3. N IS CO OP IDE A DIM 7. DEI A CO	DIMENSION THE TOTAL TERMINAL TERMINAL TONAL, BUT TIONAL, BUT TONAL, BUT TONAL	IS ARE NUMB #1 IDE IESD 9: MUST Y BE E PPLIES 30 mm ER TO I IS PO	IN MILL ER OF NTIFIEF 1 SPP BE LOO THER / TO ME FROM THE N SSIBLE S TO TI	TERMI R AND 1 -012. I CATED MOLE TALLIZ FERMI UMBEF IN A S HE EXF	RS. AF NALS. TERMI DETAIL WITHI OR M ED TE VAL TH YMME POSED	NAL N S OF IN THE IARKE ERMIN P. ERMIN TRICA	S ARE IUMB TERF E ZON D FE IAL A NALS AL FA T SIN	ERIN MINAL ME INI ATUF ND IS ON E SHIO K SLL	DEGRI IG CO L #1 II DICAT RE. S MEA EACH IN. UG AS	EES. NVENDENT FED. 1 SURE D ANI	IFIER THE T D BE	ARE ERMINA TWEEN DE RES	AL#1 SPECTI	T T T	T3255-4 T3255-5 T3255N-1 T3255N-1 T4055-1 T4055-2	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60	
1. DIM 2. ALL 3. N IS 4. THE CO OP IDE 6. DIM 0.2: 6. ND 7. DEI 6. CO 9. DR. T28	DIMENSION THE TOTAL TERMINAL FORM TO J TIONAL, BUT TIONAL, BUT MENSION IS MENSION IS AND NE REF POPULATION PLANARITY AWING CONIT S THE TOTAL THE T	IS ARE NUMB #1 IDE IESD 9: MUST Y BE E PPLIES 30 mm ER TO I IS PO APPLIE 8855-6.	IN MILL ER OF NTIFIEF 1 SPP BE LOO THER A TO ME FROM THE N SSIBLE S TO TI	IMETE TERMI R AND 1 -012. [CATED MOLE TALLIZ TERMI UMBEF IN A S HE EXF	RS. AF NALS. FERMI DETAIL WITHI OR M SED TE NAL TIE YMME POSED	NAL N S OF IN THE IARKE ERMIN P. ERMIN TRICA	S ARE IUMB TERF E ZON D FE IAL A NALS AL FA T SIN	ERIN MINAL ME INI ATUF ND IS ON E SHIO K SLL	DEGRI IG CO L #1 II DICAT RE. S MEA EACH IN. UG AS	EES. NVENDENT FED. 1 SURE D ANI	IFIER THE T D BE	ARE ERMINA TWEEN DE RES	AL#1 SPECTI	T T T	T3255-4 T3255-5 T3255N-1 T3255N-1 T4055-1 T4055-2	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60 OMMOI	3.00 3.00 3.40 3.40 DIMEN	3.10 3.10 3.50 3.50 3.50 3.50	3.20 3.20 3.20 3.60 3.60 TABLE	
1. DIM 2. ALL 3. N IS A THE CO OP IDE DIM 0.2: A ND 7. DEI A CO 9. DR, T256 WA	DIMENSION THE TOTAL TERMINAL TERMINAL TENTIONAL, BUT TIONAL, BUT TONAL TENTIFIER MA' MENSION 6 A 5 mm AND 0. AND NE REF POPULATION PLANARITY AWING CONI 855-3 AND T2 RPAGE SHAI	IS ARE . NUME #1 IDE #5 PPLIES 30 mm FER TO N IS PO APPLIE FORMS 1855-6. LL NOT	IN MILL ER OF NTIFIEF 1 SPP BE LOO THER A TO ME FROM THE N SSIBLE S TO TI TO JEI	IMETE TERMI R AND 1 -012. [CATED MOLE TALLIZ FERMI UMBEF IN A S HE EXF	RS. AF NALS. FERMI DETAIL WITHI OR M SED TE VAL TH COF TI YMME POSED D220, I	NAL N S OF IN THE IARKE ERMIN P. ERMIN TRICA) HEAT	S ARE JUMB TERF Z ON ED FE JAL A NALS AL FA T SIN PT E	ERINGUINAL MEINIGATUF ND IS ON E SHIO K SLU	DEGRI IG CO L #1 II DICA* RE. S MEA EACH IN. UG AS SED P.	EES. NVENDENT FED. 1 SURE D ANI	IFIER THE T D BE	ARE ERMINA TWEEN DE RES	AL#1 SPECTI	T T T	T3255-4 T3255-5 T3255N-1 T3255N-1 T4055-1 T4055-2	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60 OMMOI	3.00 3.00 3.40 3.40 DIMEN	3.10 3.10 3.50 3.50 3.50 3.50	3.20 3.20 3.20 3.60 3.60 TABLE	
1. DIM 2. ALL 3. N IS CO OP IDE DIM 0.2: ND 7. DEI CO 9. DR. T26 WA 11. MAI	DIMENSION THE TOTAL TERMINAL FORM TO J TIONAL, BUT TIONAL, BUT MENSION IS MENSION IS AND NE REF POPULATION PLANARITY AWING CONIT S THE TOTAL THE T	IS ARE . NUME #1 IDE #5	IN MILL EER OF NTIFIEF 1 SPP BE LOO THER A TO ME FROM THE N SSIBLE S TO TI TO JEI TO JEI KAGE C	IMETE TERMI R AND 1 -012. [CATED MOLE TALLIZ FERMI UMBEF IN A S HE EXF DEC MI RIENT.	RS. AF NALS. FERMI DETAIL WITHI OR M SED TE VAL TH YMME POSED D220, I mm. ATION	NAL N.S OF IN THE IARKE ERMIN P. ERMIN TRICA HEAT EXCEI	S ARB JUMB TERIT E ZON ED FE JAL A NALS AL FA T SIN PT E	ERIN C ERIN MINAL ME INI ATUF ND IS ON E SHIO K SLL KPOS	G CO L #1 II DICA: RE. I MEA EACH IN. UG AS BED P	EES. NVENDENT FED. 1 SURE D ANI	IFIER THE T D BE	ARE ERMINA TWEEN DE RES	AL#1 SPECTI	T T T	T3255-4 T3255-5 T3255N-1 T3255N-1 T4055-1 T4055-2	3.00 3.00 3.00 3.40 3.40	3.10 3.10 3.50 3.50	3.20 3.20 3.20 3.60 3.60 OMMOI	3.00 3.00 3.40 3.40 DIMEN	3.10 3.10 3.50 3.50 3.50 3.50	3.20 3.20 3.20 3.60 3.60 TABLE	

_Revision History

Pages changed at Rev 2: 1, 9, 17

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600