

ภาคผนวก ข.

ข้อมูลอุปกรณ์

1. ข้อมูลคุณลักษณะของทรานซิสเตอร์เบอร์ TIP29C

COMPLEMENTARY SILICON PLASTIC POWER TRANSISTORS

... designed for use in general purpose power amplifier and switching applications.

FEATURES:

* Collector-Emitter Sustaining Voltage -

$V_{CE(sus)}$ = 40V(Min)- TIP29,TIP30

60V(Min)- TIP29A,TIP30A

80V(Min)- TIP29B,TIP30B

100V(Min)-TIP29C,TIP30C

* Collector-Emitter Saturation Voltage- $V_{CE(sat)}$ = 0.7V(Max) @ $I_C = 1.0$ A

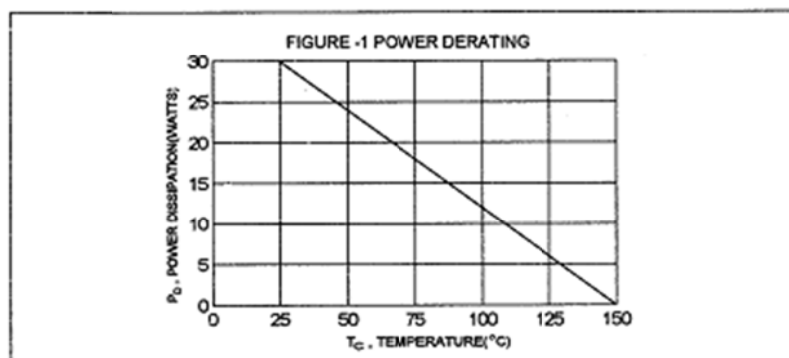
* Current Gain-Bandwidth Product $f_T = 3.0$ MHz (Min) @ $I_C = 200$ mA

MAXIMUM RATINGS

Characteristic	Symbol	TIP29 TIP30	TIP29A TIP30A	TIP29B TIP30B	TIP29C TIP30C	Unit
Collector-Emitter Voltage	V_{CE}	40	60	80	100	V
Collector-Base Voltage	V_{CB}	40	60	80	100	V
Emitter-Base Voltage	V_{EB}	5.0				V
Collector Current - Continuous - Peak	I_C	1.0 3.0				A
Base Current	I_B	0.4				A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	30 0.24				W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +150				$^\circ\text{C}$

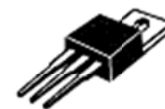
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	$R_{\theta jc}$	4.167	$^\circ\text{C/W}$

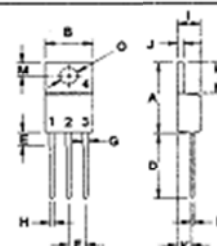


NPN	PNP
TIP29	TIP30
TIP29A	TIP30A
TIP29B	TIP30B
TIP29C	TIP30C

1.0 AMPERE
COMPLEMENTARY SILICON
POWER TRANSISTORS
40-100 VOLTS
30 WATTS



TO-220



PN 1 BASE
2 COLLECTOR
3 EMITTER
4 COLLECTOR(CASE)

DIM	MILLIMETERS	
	MIN	MAX
A	14.68	15.31
B	9.78	10.42
C	5.01	6.52
D	13.06	14.62
E	3.57	4.07
F	2.42	3.66
G	1.12	1.38
H	0.72	0.96
I	4.22	4.98
J	1.14	1.38
K	2.20	2.97
L	0.33	0.55
M	2.48	2.98
O	3.70	3.80

TIP29, TIP29A, TIP29B, TIP29C NPN / TIP30, TIP30A, TIP30B, TIP30C PNP

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Sustaining Voltage(1) ($I_C = 30\text{ mA}$, $I_B = 0$)	TIP29, TIP30 TIP29A, TIP30A TIP29B, TIP30B TIP29C, TIP30C	$V_{CE(sus)}$	40 60 80 100	V
Collector Cutoff Current ($V_{CE} = 30\text{ V}$, $I_B = 0$) ($V_{CE} = 60\text{ V}$, $I_B = 0$)	TIP29, TIP30, TIP29A, TIP30A TIP29B, TIP30B, TIP29C, TIP30C	I_{CEO}	0.3 0.3	mA
Collector Cutoff Current ($V_{CE} = 40\text{ V}$, $V_{EB} = 0$) ($V_{CE} = 60\text{ V}$, $V_{EB} = 0$) ($V_{CE} = 80\text{ V}$, $V_{EB} = 0$) ($V_{CE} = 100\text{ V}$, $V_{EB} = 0$)	TIP29, TIP30 TIP29A, TIP30A TIP29B, TIP30B TIP29C, TIP30C	I_{CES}	0.2 0.2 0.2 0.2	mA
Emitter Cutoff Current ($V_{EB} = 5.0\text{ V}$, $I_C = 0$)		I_{EBO}	1.0	mA

ON CHARACTERISTICS (1)

DC Current Gain ($I_C = 0.2\text{ A}$, $V_{CE} = 4.0\text{ V}$) ($I_C = 1.0\text{ A}$, $V_{CE} = 4.0\text{ V}$)	h_{FE}	40 15	75	
Collector-Emitter Saturation Voltage ($I_C = 1.0\text{ A}$, $I_B = 125\text{ mA}$)	$V_{CE(sat)}$		0.7	V
Base-Emitter On Voltage ($I_C = 1.0\text{ A}$, $V_{CE} = 4.0\text{ V}$)	$V_{BE(on)}$		1.3	V

DYNAMIC CHARACTERISTICS

Current Gain - Bandwidth Product (2) ($I_C = 200\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ MHz}$)	f_T	3.0		MHz
Small Signal Current Gain ($I_C = 200\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 1\text{ kHz}$)	h_{fe}	20		

(1) Pulse Test: Pulse width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$ (2) $f_T = |h_{fe}| \cdot f_{\text{TEST}}$

TIP29, TIP29A, TIP29B, TIP29C, NPN / TIP30, TIP30A, TIP30B, TIP30C, PNP

FIG-2 TURN-ON TIME

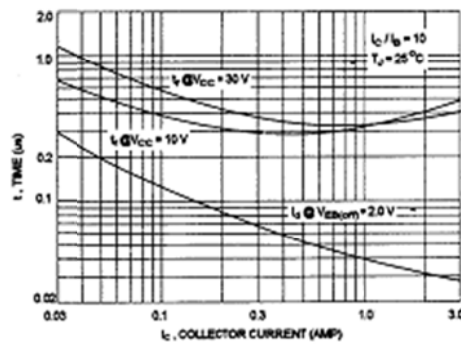


FIGURE 3 - SWITCHING TIME EQUIVALENT CIRCUIT

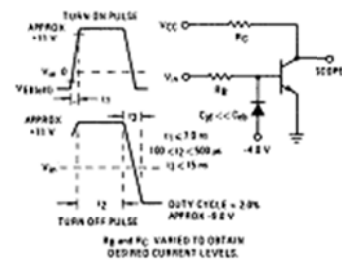


FIG-4 DC CURRENT GAIN

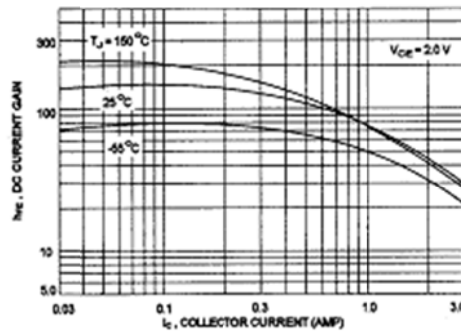


FIG-5 TURN-OFF TIME

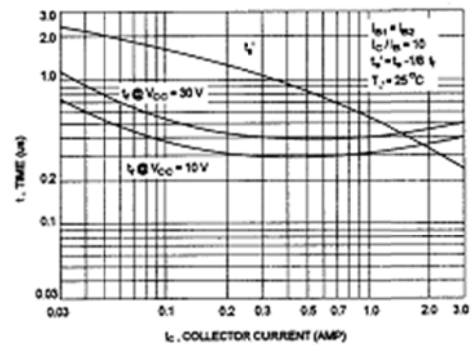
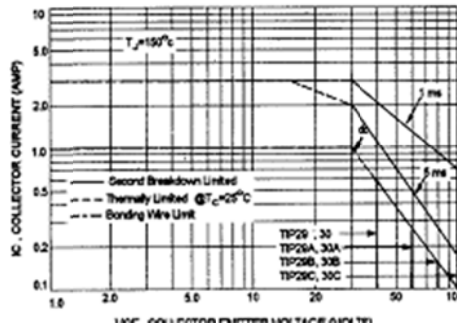


FIG-6 ACTIVE REGION SAFE OPERATING AREA



There are two limitation on the power handling ability of a transistor: average junction temperature and second breakdown safe operating area curves indicate I_C - V_{CE} limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater dissipation than curves indicate.

The data of FIG-6 curve is base on $T_{J,avg} = 150^\circ\text{C}$; T_C is variable depending on power level, second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J,avg} \leq 150^\circ\text{C}$. At high case temperatures, thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

2. ข้อมูลคุณลักษณะของออปโตทรานซิสเตอร์เบอร์ TLP621

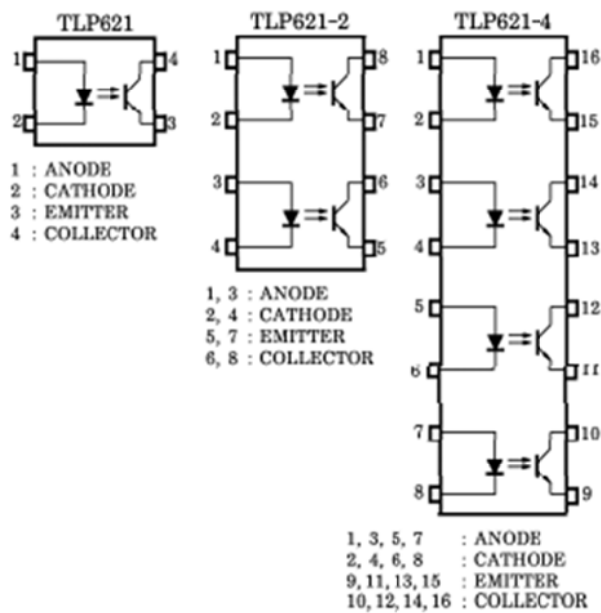
TLP621, TLP621-2, TLP621-4

PROGRAMMABLE CONTROLLER
AC/DC - INPUT MODULE
SOLID STATE RELAY

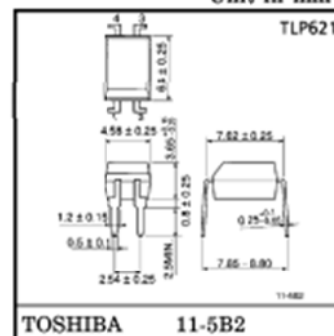
The TOSHIBA TLP621, -2, and -4 consists of a photo-transistor optically coupled to a gallium arsenide infrared emitting diode. The TLP621-2 offers two isolated channels in an eight lead plastic DIP, which the TLP621-4 provides four isolated channels in a sixteen plastic DIP.

- Collector-Emitter Voltage : 55V (Min.)
 - Current Transfer Ratio : 50% (Min.)
- Rank GB : 100% (Min.)

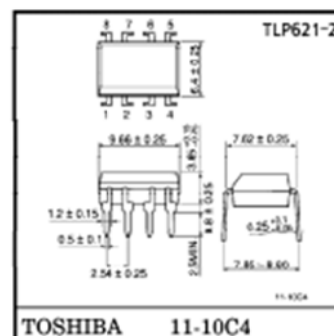
PIN CONFIGURATIONS (TOP VIEW)



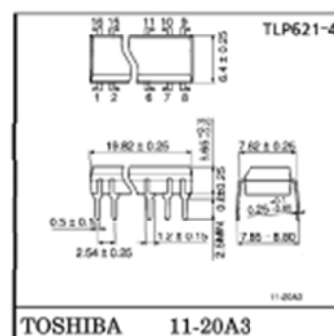
Unit in mm



Weight : 0.26g



Weight : 0.54g



Weight : 1.1g

● Current Transfer Ratio

TYPE	CLASSI- FICATION *1	CURRENT TRANSFER RATIO (%) (I_C / I_F)		MARKING OF CLASSIFICATION
		$I_F=5\text{mA}$, $V_{CE}=5\text{V}$, $T_a=25^\circ\text{C}$		
		MIN.	MAX.	
TLP621	(None)	50	600	BLANK, Y, Y■, G, G■, B, B■, GB
	Rank Y	50	150	Y, Y■
	Rank GR	100	300	G, G■
	Rank BL	200	600	B, B■
	Rank GB	100	600	G, G■, B, B■, GB
TLP621-2	(None)	50	600	BLANK, GR, BL, GB
TLP621-4	Rank GB	100	600	GR, BL, GB

*1 : Ex. Rank GB : TLP621 (GB)

(Note) Application type name for certification test, please use standard product type name, i.e.

TLP621 (GB) : TLP621
TLP621-2 (GB) : TLP621-2

	MADE IN JAPAN		MADE IN THAILAND	
UL Recognized	E67349	*2	E152349	*2
BSI Approved	6508, 7445	*3	6505, 7445	*3
SEMKO Approved	9735090/01	*4	—	

*2 UL1577

*3 BS EN60065 : 1994, BS EN60950 : 1992

*4 EN60950 (Approved is TLP621 only)

- Option (D4) type
 VDE Approved : DIN VDE0884 / 06.92, Certificate No. 68384
 Maximum Operating Insulation Voltage : 890V_{PK}
 Highest Permissible Over Voltage : 8000V_{PK}

(Note) When a VIDE0884 approved type is needed, please designate the "Option (D4)"

	7.62mm pitch standard type	10.16mm pitch (LFZ) type
Creepage Distance	: 6.4mm (Min.)	8.0mm (Min)
Clearance	: 6.4mm (Min.)	8.0mm (Min)
Insulation Thickness	: 0.4mm (Min.)	0.4mm (Min)

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING		UNIT
			TLP621	TLP621-2 TLP621-4	
LED	Forward Current	I _F	60	50	mA
	Forward Current Derating	ΔI _F / °C	-0.7 (Ta > 39°C)	-0.5 (Ta = 25°C)	mA / °C
	Pulse Forward Current	I _{FP}	1 (100μs pulse, 100pps)		A
	Power Dissipation	P _D	100	70	mW
	Power Dissipation Derating	ΔP _D / °C	-1.0	-0.7	mW / °C
	Reverse Voltage	V _R	5		V
	Junction Temperature	T _j	125		°C
DETECTOR	Collector-Emitter Voltage	V _{CEO}	55		V
	Emitter-Collector Voltage	V _{ECO}	7		V
	Collector Current	I _C	50		mA
	Collector Power Dissipation (1 Circuit)	P _C	150	100	mW
	Collector Power Dissipation Derating (1 Circuit, Ta ≥ 25°C)	ΔP _C / °C	-1.5	-1.0	mW / °C
	Junction Temperature	T _j	125		°C
	Storage Temperature Range	T _{stg}	-55~125		°C
Operating Temperature Range		T _{opr}	-55~100		°C
Lead Soldering Temperature		T _{sol}	260 (10s)		°C
Total Package Power Dissipation		P _T	250	150	mW
Total Package Power Dissipation Derating (Ta ≥ 25°C)		ΔP _T / °C	-2.5	-1.5	mW / °C
Isolation Voltage (Note 1)		BV _S	5000 (AC, 1min., R.H. ≤ 60%)		V _{rms}

(Note 1) Device considered a two terminal : LED side pins shorted together, and DETECTOR side pins shorted together.

RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V _{CC}	—	5	24	V
Forward Current	I _F	—	16	20	mA
Collector Current	I _C	—	1	10	mA
Operating Temperature	T _{opr}	-25	—	85	°C

INDIVIDUAL ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
LED	Forward Voltage	V_F	$I_F = 10\text{mA}$	1.0	1.15	1.3	V
	Reverse Current	I_R	$V_R = 5\text{V}$	—	—	10	μA
	Capacitance	C_T	$V = 0, f = 1\text{MHz}$	—	30	—	pF
DETECTOR	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 0.5\text{mA}$	55	—	—	V
	Emitter-Collector Breakdown Voltage	$V_{(BR)ECO}$	$I_E = 0.1\text{mA}$	7	—	—	V
	Collector Dark Current	I_{CEO}	$V_{CE} = 24\text{V}$	—	10	100	nA
			$V_{CE} = 24\text{V}, T_a = 85^\circ\text{C}$	—	2	50	μA
	Capacitance (Collector to Emitter)	C_{CE}	$V = 0, f = 1\text{MHz}$	—	10	—	pF

COUPLED ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Current Transfer Ratio	I_C / I_F	$I_F = 5\text{mA}, V_{CE} = 5\text{V}$ Rank GB	50	—	600	%
			100	—	600	
Saturated CTR	$I_C / I_F (\text{sat})$	$I_F = 1\text{mA}, V_{CE} = 0.4\text{V}$ Rank GB	—	60	—	%
			30	—	—	
Collector-Emitter Saturation Voltage	$V_{CE} (\text{sat})$	$I_C = 2.4\text{mA}, I_F = 8\text{mA}$	—	—	0.4	V
		$I_C = 0.2\text{mA}, I_F = 1\text{mA}$ Rank GB	—	0.2	—	
			—	—	0.4	

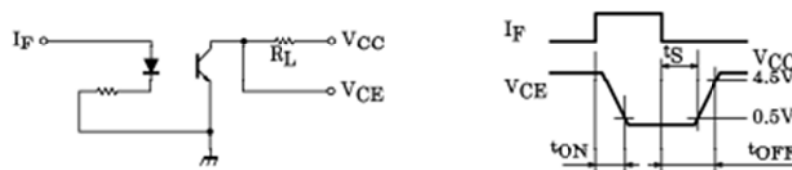
ISOLATION CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Capacitance (Input to Output)	C_S	$V_S = 0, f = 1\text{MHz}$	—	0.8	—	pF
Isolation Resistance	R_S	$V_S = 500\text{V}$	1×10^{12}	10^{14}	—	Ω
Isolation Voltage	BV_S	AC, 1 minute	5000	—	—	V_{rms}
		AC, 1 second, in oil	—	10000	—	
		DC, 1 minute, in oil	—	10000	—	V_{dc}

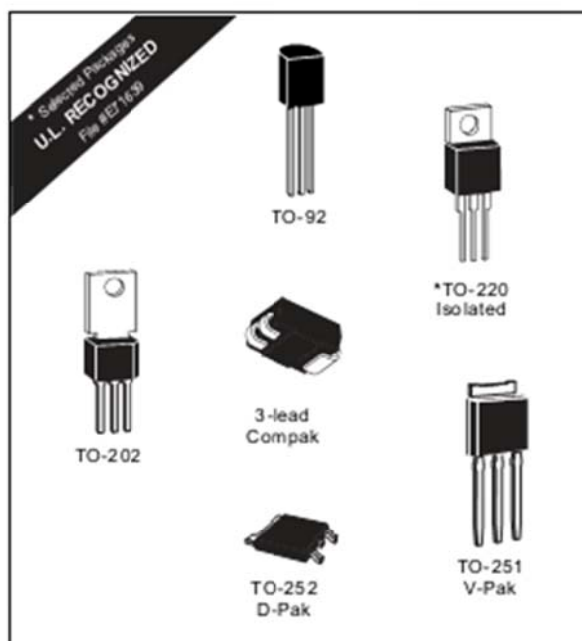
SWITCHING CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Rise Time	t_r	$V_{CC} = 10\text{V}, I_C = 2\text{mA}$ $R_L = 100\Omega$	—	2	—	μs
Fall Time	t_f		—	3	—	
Turn-on Time	t_{on}		—	3	—	
Turn-off Time	t_{off}		—	3	—	
Turn-on Time	t_{ON}	$R_L = 1.9\text{k}\Omega$ (Fig.1) $V_{CC} = 5\text{V}, I_F = 16\text{mA}$	—	2	—	μs
Storage Time	t_S		—	15	—	
Turn-off Time	t_{OFF}		—	25	—	

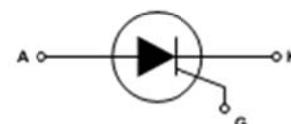
Fig.1 SWITCHING TIME TEST CIRCUIT



3. ข้อมูลคุณลักษณะของเอสซีอาร์เบอร์ S6006SL3



E5



Sensitive SCRs

(0.8 A to 10 A) RoHS

General Description

The Teccor line of sensitive SCR semiconductors are half-wave unidirectional, gate-controlled rectifiers (SCR-thyristor) which complement Teccor's line of power SCRs. This group of packages offers ratings of 0.8 A to 10 A, and 200 V to 600 V with gate sensitivities of 12 μ A to 500 μ A. For gate currents in the 10 mA to 50 mA ranges, see "SCRs" section of this catalog.

The TO-220 and TO-92 are electrically isolated where the case or tab is internally isolated to allow the use of low-cost assembly and convenient packaging techniques.

Teccor's line of SCRs features glass-passivated junctions to ensure long-term device reliability and parameter stability. Teccor's glass offers a rugged, reliable barrier against junction contamination.

Tape-and-reel packaging is available for the TO-92 package. Consult the factory for more information.

Variations of devices covered in this data sheet are available for custom design applications. Consult the factory for more information.

Features

- RoHS Compliant
- Electrically-isolated TO-220 package
- High voltage capability — up to 600 V
- High surge capability — up to 100 A
- Glass-passivated chip

Compak Features

- Surface mount package — 0.8 A series
- New small-profile three-leaded Compak package
- Four gate sensitivities available
- Packaged in embossed carrier tape with 2,500 devices per reel
- Can replace SOT-223

TYPE	Part Number				I _T (1)		V _{DRM} & V _{RRM}	I _{GT} (2) (12)	I _{DRM} & I _{RRM} (20) (21)		V _{TM} (3) (10)
	Isolated	Non-isolated							μAmps		
											
	TO-220	TO-202	TO-251 V-Pak	TO-252 D-Pak							
	See "Package Dimensions" section for variations. (11)				I _{T(RMS)} MAX	I _{T(AV)} MAX			Volts MIN	μAmps MAX	
6 A	S2006LS2	S2006FS21	S2006VS2	S2006DS2	6	3.8	200	200	5	250	1.6
	S4006LS2	S4006FS21	S4006VS2	S4006DS2	6	3.8	400	200	5	250	1.6
	S6006LS2	S6006FS21	S6006VS2	S6006DS2	6	3.8	600	200	5	250	1.6
	S2006LS3	S2006FS31	S2006VS3	S2006DS3	6	3.8	200	500	5	250	1.6
	S4006LS3	S4006FS31	S4006VS3	S4006DS3	6	3.8	400	500	5	250	1.6
	S6006LS3	S6006FS31	S6006VS3	S6006DS3	6	3.8	600	500	5	250	1.6
8 A	S2008LS2	S2008FS21	S2008VS2	S2008DS2	8	5.1	200	200	5	250	1.6
	S4008LS2	S4008FS21	S4008VS2	S4008DS2	8	5.1	400	200	5	250	1.6
	S6008LS2	S6008FS21	S6008VS2	S6008DS2	8	5.1	600	200	5	250	1.6
	S2008LS3	S2008FS31	S2008VS3	S2008DS3	8	5.1	200	500	5	250	1.6
	S4008LS3	S4008FS31	S4008VS3	S4008DS3	8	5.1	400	500	5	250	1.6
	S6008LS3	S6008FS31	S6008VS3	S6008DS3	8	5.1	600	500	5	250	1.6
10 A	S2010LS2	S2010FS21	S2010VS2	S2010DS2	10	6.4	200	200	5	250	1.6
	S4010LS2	S4010FS21	S4010VS2	S4010DS2	10	6.4	400	200	5	250	1.6
	S6010LS2	S6010FS21	S6010VS2	S6010DS2	10	6.4	600	200	5	250	1.6
	S2010LS3	S2010FS31	S2010VS3	S2010DS3	10	6.4	200	500	5	250	1.6
	S4010LS3	S4010FS31	S4010VS3	S4010DS3	10	6.4	400	500	5	250	1.6
	S6010LS3	S6010FS31	S6010VS3	S6010DS3	10	6.4	600	500	5	250	1.6

Specific Test Conditions

di/dt — Maximum rate-of-change of on-state current; $I_{GT} = 50$ mA pulse width ≥ 15 μ sec with ≤ 0.1 μ s rise time

dv/dt — Critical rate-of-rise of forward off-state voltage

$\bar{I}_T$ — RMS surge (non-repetitive) on-state current for period of 8.3 ms for fusing

I_{ORM} and I_{RRM} — Peak off-state current at V_{DRM} and V_{RRM}

I_{GT} — DC gate trigger current $V_D = 6$ V dc; $R_L = 100$ Ω

I_{GM} — Peak gate current

I_H — DC holding current; initial on-state current = 20 mA

I_T — Maximum on-state current

I_{TSM} — Peak one-cycle forward surge current

$P_{G(AV)}$ — Average gate power dissipation

P_{GM} — Peak gate power dissipation

t_{gt} — Gate controlled turn-on time gate pulse = 10 mA; minimum width = 15 μ s with rise time ≤ 0.1 μ s

t_q — Circuit commutated turn-off time

V_{DRM} and V_{RRM} — Repetitive peak off-state forward and reverse voltage

V_{GRM} — Peak reverse gate voltage

V_{GT} — DC gate trigger voltage; $V_D = 6$ V dc; $R_L = 100$ Ω

V_{TM} — Peak on-state voltage

General Notes

- Teccor 2N5064 and 2N6565 Series devices conform to all JEDEC registered data. See specifications table on pages E5 - 2 and E5 - 3.
- The case lead temperature (T_C or T_L) is measured as shown on dimensional outline drawings in the "Package Dimensions" section of this catalog.
- All measurements (except I_{GT}) are made with an external resistor $R_{GK} = 1$ k Ω unless otherwise noted.
- All measurements are made at 60 Hz with a resistive load at an ambient temperature of $+25^\circ C$ unless otherwise specified.
- Operating temperature (T_J) is $-65^\circ C$ to $+110^\circ C$ for EC Series devices, $-65^\circ C$ to $+125^\circ C$ for 2N Series devices, $-40^\circ C$ to $+125^\circ C$ for "TCR" Series, and $-40^\circ C$ to $+110^\circ C$ for all others.
- Storage temperature range (T_S) is $-65^\circ C$ to $+150^\circ C$ for TO-92 devices, $-40^\circ C$ to $+150^\circ C$ for TO-202 and Compak devices, and $-40^\circ C$ to $+125^\circ C$ for all others.
- Lead solder temperature is a maximum of $+230^\circ C$ for 10 seconds maximum $\geq 1/16"$ (1.59 mm) from case.

V _{GT}			I _H	I _{GM}	V _{GRM}	P _{GM}	P _{G(AV)}	I _{TSM}	dv/dt	di/dt	t _{gt}	t _q	I ² t
(4) (12) (22)			(5) (19)	(17)		(17)		(6) (13)			(8)	(9)	
Volts			mAmps	Amps	Volts	Watts	Watts	Amps	Volts/μSec	Amps/μSec	μSec	μSec	Amps ² Sec
T _C = -40 °C	T _C = 25 °C	T _C = 110 °C							T _C = 110 °C				
MAX			MAX		MIN			60/50 Hz	TYP		TYP	MAX	
1	0.8	0.25	6	1	6	1	0.1	100/83	10	100	4	50	41
1	0.8	0.25	6	1	6	1	0.1	100/83	8	100	4	50	41
1	0.8	0.25	6	1	6	1	0.1	100/83	8	100	4	50	41
1	0.8	0.25	8	1	6	1	0.1	100/83	10	100	5	45	41
1	0.8	0.25	8	1	6	1	0.1	100/83	8	100	5	45	41
1	0.8	0.25	8	1	6	1	0.1	100/83	8	100	5	45	41
1	0.8	0.25	6	1	6	1	0.1	100/83	10	100	4	50	41
1	0.8	0.25	6	1	6	1	0.1	100/83	8	100	4	50	41
1	0.8	0.25	6	1	6	1	0.1	100/83	8	100	4	50	41
1	0.8	0.25	8	1	6	1	0.1	100/83	10	100	5	45	41
1	0.8	0.25	8	1	6	1	0.1	100/83	8	100	5	45	41
1	0.8	0.25	8	1	6	1	0.1	100/83	8	100	5	45	41
1	0.8	0.25	6	1	6	1	0.1	100/83	10	100	4	50	41
1	0.8	0.25	6	1	6	1	0.1	100/83	8	100	4	50	41
1	0.8	0.25	8	1	6	1	0.1	100/83	10	100	5	45	41
1	0.8	0.25	8	1	6	1	0.1	100/83	8	100	5	45	41
1	0.8	0.25	6	1	6	1	0.1	100/83	10	100	4	50	41
1	0.8	0.25	6	1	6	1	0.1	100/83	8	100	4	50	41
1	0.8	0.25	8	1	6	1	0.1	100/83	10	100	5	45	41
1	0.8	0.25	8	1	6	1	0.1	100/83	8	100	5	45	41
1	0.8	0.25	8	1	6	1	0.1	100/83	8	100	5	45	41
1	0.8	0.25	8	1	6	1	0.1	100/83	8	100	5	45	41

4. ข้อมูลคุณลักษณะของไดโอดเบอร์ 1N6519

2,000 V - 10,000 V Rectifiers

0.5 A - 2.0 A Forward Current

70 ns Recovery Time

**1N6513 1N6515
1N6517 1N6519**

AXIAL LEADED
HERMETICALLY SEALED
MIL-PRF-19500/575



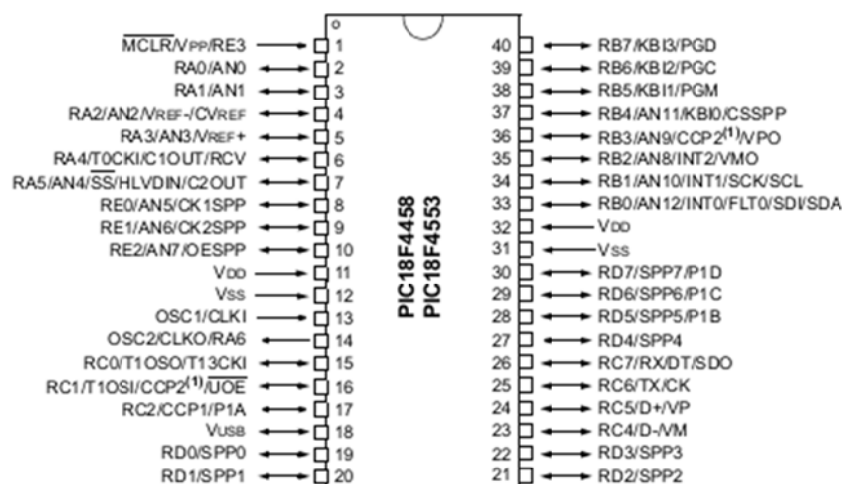
JANTX JANTXV

ELECTRICAL CHARACTERISTICS AND MAXIMUM RATINGS

Part Number	Working Reverse Voltage (V _{rw})	Average Rectified Current (I _o)		Reverse Current @ V _{rw} (I _r)		Forward Voltage (V _f)		1 Cycle Surge Current tp=8.3ms (I _{fsm})	Repetitive Surge Current (I _{fsm})	Reverse Recovery Time (3) (T _{rr})	Thermal Impedance θ _{J-L}			Junction Cap. @50VDC @ 1kHz (C _j)
											L=000	L=.125	L=.250	
	Volts	55°C(1) Amps	100°C(2) Amps	25°C μA	100°C μA	25°C Volts	Amps	25°C Amps	25°C Amps	ns	°C/W	°C/W	°C/W	25°C pF
1N6513	2000	2.00	1.50	1.0	25	3.5	2.0	100	15	70	3	6	12	25
1N6515	3000	1.50	1.00	1.0	25	6.0	1.5	60	10	70	3	6	12	20
1N6517	5000	1.00	0.50	1.0	25	8.0	1.0	40	8	70	3	6	12	16
1N6519	10000	0.50	0.25	1.0	25	13.0	0.5	25	5	70	3	6	12	8

(1)TL=55°C L=0.375" (2)TL=100°C L=0.375" (3)If=0.5A, Ir=1.0A, Irr=0.25A • Op.Temp.= -65°C to +175°C Stg.Temp.= -65°C to +200°C

40-Pin PDIP



1.0 DEVICE OVERVIEW

This document contains device-specific information for the following devices:

- PIC18F2458
- PIC18F4458
- PIC18F2553
- PIC18F4553

Note: This data sheet documents only the devices' features and specifications that are in addition to the features and specifications of the PIC18F2455/2550/4455/4550 devices. For information on the features and specifications shared by the PIC18F2458/2553/4458/4553 and PIC18F2455/2550/4455/4550 devices, see the "PIC18F2455/2550/4455/4550 Data Sheet" (DS39632).

The PIC18F4553 family of devices offers the advantages of all PIC18 microcontrollers – namely, high computational performance at an economical price – with the addition of high-endurance, Enhanced Flash program memory. In addition to these features, the PIC18F4553 family introduces design enhancements that make these microcontrollers a logical choice for many high-performance, power sensitive applications.

1.1 Special Features

- 12-Bit A/D Converter:** The PIC18F4553 family implements a 12-bit A/D Converter. The A/D Converter incorporates programmable acquisition time. This allows for a channel to be selected and a conversion to be initiated, without waiting for a sampling period and thus, reducing code overhead.

1.2 Details on Individual Family Members

The PIC18F2458/2553/4458/4553 devices are available in 28-pin and 40/44-pin packages. Block diagrams for the two groups are shown in Figure 1-1 and Figure 1-2.

The devices are differentiated from each other in the following ways:

- Flash program memory (24 Kbytes for PIC18FX458 devices, 32 Kbytes for PIC18FX553).
- A/D channels (10 for 28-pin devices, 13 for 40-pin and 44-pin devices).
- I/O ports (3 bidirectional ports and 1 input only port on 28-pin devices, 5 bidirectional ports on 40-pin and 44-pin devices).
- CCP and Enhanced CCP implementation (28-pin devices have two standard CCP modules, 40-pin and 44-pin devices have one standard CCP module and one ECCP module).
- Streaming Parallel Port (present only on 40/44-pin devices).

All other features for devices in this family are identical. These are summarized in Table 1-1.

The pinouts for all devices are listed in Table 1-2 and Table 1-3.

Members of the PIC18F4553 family are available as both standard and low-voltage devices. Standard devices with Enhanced Flash memory, designated with an "F" in the part number (such as PIC18F2458), accommodate an operating VDD range of 4.2V to 5.5V. Low-voltage parts, designated by "LF" (such as PIC18LF2458), function over an extended VDD range of 2.0V to 5.5V.

TABLE 1-1: DEVICE FEATURES

Features	PIC18F2458	PIC18F2553	PIC18F4458	PIC18F4553
Operating Frequency	DC – 48 MHz	DC – 48 MHz	DC – 48 MHz	DC – 48 MHz
Program Memory (Bytes)	24576	32768	24576	32768
Program Memory (Instructions)	12288	16384	12288	16384
Data Memory (Bytes)	2048	2048	2048	2048
Data EEPROM Memory (Bytes)	256	256	256	256
Interrupt Sources	19	19	20	20
I/O Ports	Ports A, B, C, (E)	Ports A, B, C, (E)	Ports A, B, C, D, E	Ports A, B, C, D, E
Timers	4	4	4	4
Capture/Compare/PWM Modules	2	2	1	1
Enhanced Capture/Compare/PWM Modules	0	0	1	1
Serial Communications	MSSP, Enhanced USART	MSSP, Enhanced USART	MSSP, Enhanced USART	MSSP, Enhanced USART
Universal Serial Bus (USB) Module	1	1	1	1
Streaming Parallel Port (SPP)	No	No	Yes	Yes
12-Bit Analog-to-Digital Converter Module	10 Input Channels	10 Input Channels	13 Input Channels	13 Input Channels
Comparators	2	2	2	2
Resets (and Delays)	POR, BOR, WDT, RESET Instruction, Stack Full, Stack Underflow, MCLR (optional), (PWRT, OST)	POR, BOR, WDT, RESET Instruction, Stack Full, Stack Underflow, MCLR (optional), (PWRT, OST)	POR, BOR, WDT, RESET Instruction, Stack Full, Stack Underflow, MCLR (optional), (PWRT, OST)	POR, BOR, WDT, RESET Instruction, Stack Full, Stack Underflow, MCLR (optional), (PWRT, OST)
Programmable High/Low-Voltage Detect	Yes	Yes	Yes	Yes
Programmable Brown-out Reset	Yes	Yes	Yes	Yes
Instruction Set	75 Instructions; 83 with Extended Instruction Set Enabled	75 Instructions; 83 with Extended Instruction Set Enabled	75 Instructions; 83 with Extended Instruction Set Enabled	75 Instructions; 83 with Extended Instruction Set Enabled
Packages	28-Pin SPDIP 28-Pin SOIC	28-Pin SPDIP 28-Pin SOIC	40-Pin PDIP 44-Pin QFN 44-Pin TQFP	40-Pin PDIP 44-Pin QFN 44-Pin TQFP
Corresponding Devices with 10-Bit A/D	PIC18F2455	PIC18F2550	PIC18F4455	PIC18F4550